THE GAS JOURNAL

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A Glance at the Contents—

Industrial Development at Arbroath.

A large industrial gas-fired boiler has been installed by the Arbroath Gas Department. It is described and illustrated on p. 550.

Gas Company Meetings.

Reports are published of the Annual General Meetings of the Wandsworth and District Gas Company and the Tottenham and District Gas Company. [pp. 560 and 562.]

Coke Oven Gas for Public Purposes.

The economic use of surplus coke oven gas for public purposes was discussed by Mr. T. Biddulph-Smith, F.C.S., before a meeting of the Cleveland Institution of Engineers. [p. 547.]

Great Wigston Gas Order.

At the Offices of the Board of Trade in London on Feb. 23, Mr. J. F. Ronca (Director of Gas Administration) held and inquiry into an application by the Great Wigston Gas Company for a Special Order under the Gas Regulation Act. [p. 546.]

Construction of a Spiral-Guided Holder.

In a paper before the Yorkshire Junior Gas Association, Mr. L. R. Cowley, of Shipley, discussed special features in the construction of a 300,000 c.ft. spiral-guided gasholder erected in the tank of an old holder of similar capacity. [p. 548.]

Engineer and Manager Required.

The Torquay and Paignton Gas Company invites applications for the post of Engineer and Manager. The salary is £1,000 a year, with residence, fuel, and light. [p. 570.]

Gas Salesmen at the Fair.

Friday, Feb. 23, was Gas Salesmen's Day at the Fair, and a large number attended from all parts of the country. The visitors were entertained at luncheon by the Fair authorities. [p. 545.]

Industrial Gas Heating.

In a paper before the London and Southern District Junior Gas Association Mr. P. Lloyd, of the Gas Light and Coke Company, discussed some aspects of industrial gas heating. [p. 557.]

Benzole from Vertical Retort Gas.

Mr. C. H. Chester, General Manager and Secretary of the Swindon United Gas Company, explains what success has attended the recovery of benzole from gas produced in continuous vertical retorts. [p. 551.]

The Junior Associations at the Fair.

Members of the Junior Gas Associations from all quarters of the country converged upon Castle Bromwich on Thursday of last week, when they were entertained at luncheon at the kind invitation of the Birmingham Chamber of Commerce, and spent an interesting day inspecting the exhibits at the British Industries Fair. [p. 543.]

Forthcoming Engagements

March 8.—MIDLAND ASSOCIATION OF GAS ENGINEERS.—Annual Meeting, Grand Hotel, Birmingham, at 2.30.

March 8.—MIDLAND JUNIOR ASSOCIATION.—Meeting. Paper by Mr. H. J. Reynolds.

March 10.—WESTERN JUNIOR ASSOCIATION.—Meeting at Plymouth. Paper by Mr. A. R. Langford.

March 10.—SCOTTISH JUNIOR ASSOCIATION (WESTERN DISTRICT).—Annual Business Meeting. Paper by Mr. H. S. Milne.

March 14.—I.G.E.—Meeting of Meters Committee, 2.30 p.m.

March 14.—YORKSHIRE JUNIOR ASSOCIATION.—Joint Meeting at Warrington with Manchester and District Juniors. Paper by Dr. Winter.

March 16.—LONDON AND SOUTHERN JUNIOR ASSOCIATION.—Meeting. Paper by Mr. L. T. Minchin.

March 16.—SOUTHERN ASSOCIATION OF GAS ENGINEERS AND MANAGERS (WESTERN DISTRICT).—Commercial Meeting at the Rougemont Hotel, Exeter, 2.30 p.m.

March 21.—B.C.G.A.—Meeting of Executive Committee, 12 noon, 28, Grosvenor Gardens, S.W. 1.

March 23.—MANCHESTER DISTRICT ASSOCIATION. — Annual Meeting at the Midland Hotel, Manchester. Luncheon, 1 p.m. Business Meeting, 2.30 p.m. Presidential Address of Mr. F. G. Shaw.

March 24.—YORKSHIRE JUNIOR ASSOCIATION.—Meeting at Batley.

March 27.—SOUTHERN ASSOCIATION.—Annual General Meeting, Hotel Metropole, London, 2 p.m.

April 6.—NORTH BRITISH ASSOCIATION.—Spring Meeting at Perth.

April 6.—LONDON AND SOUTHERN JUNIOR ASSOCIATION.—Meeting. Paper by Mr. H. H. Brown.

April 7.—MANCHESTER AND DISTRICT JUNIOR ASSOCIATION.—Annual Dinner. Paper by Mr. H. Platt.

April 7.—SCOTTISH EASTERN JUNIOR ASSOCIATION.—Visit to Messrs. J. G. Stein & Co., Castle Carey. Paper by Mr. R. Malcolm.

April 12.—MIDLAND JUNIOR ASSOCIATION.—Meeting. Paper by Mr. F. H. Bate.

April 21.—YORKSHIRE JUNIOR ASSOCIATION.—Meeting at Rotherham. Paper by Dr. Heathcote.

April 21.—WESTERN JUNIOR ASSOCIATION.—Meeting at Bath Presidential Address and Annual General Meeting.

April 26.—MIDLAND JUNIOR ASSOCIATION.—Annual Meeting. Address by Mr. R. S. Ramsden.

May 4.—LONDON AND SOUTHERN JUNIOR ASSOCIATION.—Annual Business Meeting.

May 9.—MANCHESTER AND DISTRICT JUNIOR ASSOCIATION.—Visit to Mossley. Paper by Mr. T. Hibbs.

May 12.—SCOTTISH EASTERN JUNIOR ASSOCIATION.—Annual General Meeting and Paperette Day in Heriot Watt College, Edinburgh.

EDITORIAL NOTES

A Gratifying Response

THOUGH already there has been a gratifying response to the appeal made for donations by the Sir Arthur Duckham Memorial Fund Committee, we are doubtless as yet only at the beginning of a big response. The Committee's letter and our editorial reference thereto (p. 358) explain the objects of the Fund, which, even apart from personal considerations, is deserving of generous support by the great Gas Industry.

The first list of donors, which we published last week, contained 65 names, and to-day there is a further substantial number to be added. It is desired that the Fund should be both representative and large. Already it is representative, for the donations received have ranged from 5s. to £1,000; and it is well on the way to becoming a large Fund. Many gas undertakings have already given, or promised to give, on the basis suggested by the Institution of Gas Engineers, particulars of which, if not yet received, can be obtained from the Secretary of the Institution. It is pleasing to learn that there has been a noteworthy response from municipal gas undertakings; while several contributions have been received from persons who have no connection with the gas or allied industries, but who recognized in Sir Arthur Duckham "a great man whose death was a loss to the country."

It may be pointed out here that the Gas Industry will be the chief beneficiary, since, though the appeal is of a national character, the Fund is to be devoted to the prosecution of research of interest to the Gas Industry. It is necessary, therefore, to raise a substantial sum if the proposed "Duckham Award" is to be outstandingly effective. At the same time, the smallest of contributions will be gratefully welcomed so as to make the tribute to the late Sir Arthur of widespread significance.

The Government Bill

AT last we are in the happy position of being able to announce the appearance of the long wished for Government Bill to amend the law with respect to gas undertakings. The text of the measure, which has been introduced in the House of Lords, was published last Friday. There are 28 clauses, and three schedules. The first four clauses deal with Capital and Renewal Funds, and the next two with Charges for Gas. Clauses 7, 8, and 9 relate to Non-Statutory Undertakers and Undertakers other than Thermal Unit Undertakers, and these are followed by five clauses referring to Amendments of Principal Act, and 14 concerning Miscellaneous and General Matters. Of the schedules, the first recites provisions as to issue and redemption of redeemable and redeemed stock by companies incorporated by Act of Parliament, the second enumerates minor amendments, and the third specifies enactments repealed.

The final report of the Gas Legislation Committee, presided over by Mr. F. J. Wrottesley, K.C. (the main features of which were indicated on pages 206-7 of the "JOURNAL" for April 26 last), provides the explanation of subjects dealt with in the Bill. It will be recalled that the Committee expressed the opinion that there is little doubt that the operation of the auction clause to-day hampers undertakers in their endeavours to raise capital, and, further, that it deters many investors from applying for shares or stock. Accordingly, they saw no objection to a general extension of the power to offer capital for subscription to the public on terms to be approved. They also recommended that power be given to all statutory gas undertakings to issue redeemable preference capital or debenture stock. These views are now given effect to.

The financial clauses of the Bill before us give power to the Board of Trade to authorize companies, subject to such conditions as the Board of Trade may think fitting to impose, to offer for subscription by the public any share capital before, or in lieu of, offering it by public auction or tender. Where, on an application under this section, it appears to the Board that share capital of the applicants of the same class as that to which the application relates is quoted on the London Stock Exchange and has been dealt in on that exchange during the month immediately preceding the application, the Board shall not authorize the capital to be offered at a price less than the average market price during that month. Where similar capital is not quoted or has not been dealt in during the month immediately preceding the application, the Board must be satisfied that the proposed terms of the offer are the best obtainable. Share capital that has been already offered for sale by auction or tender, and not disposed of, may be disposed of by the Directors as they deem best for securing the highest price obtainable.

There are provisions for the payment of underwriting commission not exceeding 1½%, or, if the Board of Trade consent, 3%, of the price at which the capital is issued; and this section is not to affect the power of undertakers to pay such brokerage as they have previously been enabled to pay. Statutory undertakings are to be authorized to issue redeemable preference capital and debenture stock, with advantages that recent market conditions have emphasized.

With regard to the limits of the renewal fund, again the Bill appears to follow closely the recommendations of the Committee. The aggregate amount contributed to the fund in any year shall not exceed ½% of the capital, and the amount of the fund shall not exceed 5%. Where, however, the Board of Trade are satisfied either that the undertakers have not supplied more than 5 million therms in the form of gas during any of the five years immediately preceding the date of any application to them, or that the undertakers are not "thermal unit" undertakers, they may authorize the amount of the renewal fund to be increased to 7½%, subject to certain stipulations.

Special Contracts and Bulk Supplies

THE Bill amends section 13 of the Gas-Works Clauses Act, 1847, which empowers undertakers to enter into contracts; and as amended the section and its proviso will read as follows: The undertakers may from time to time enter into any contract with any person for lighting or supplying with gas any public or private building, *or any premises*, or for providing any person with pipes, burners, meters, and lamps, and for the repair thereof; and may also from time to time enter into any contract with the commissioners, trustees, or other persons having the control of the streets within the limits of the Special Act for lighting the same or any of them with gas, and for providing such commissioners, trustees, or persons with lamps, lamp posts, burners, and pipes for such purposes, and for the repair thereof, in such a manner and upon such terms as shall be agreed upon between the undertakers and the said commissioners, trustees, or other persons: *Provided that the terms of every contract made under this section in the like circumstances and for the same purposes shall be alike.* The words printed in italics are the additions made by the Bill. This section will be deemed to be incorporated in every enactment authorizing undertakers to supply gas, whether passed or made before or after the commencement of this Act; and any provision of any enactment passed or made before the commencement of this Act shall, in so far as it amends the section otherwise than as provided by this section, cease to have effect. But

nothing in this sub-section shall affect any contract made before the commencement of this Act.

"Thermal unit" undertakers may give notice of the price per therm at which they are prepared to supply gas to persons who do not enter into a special contract; and where such notice has been given the following (among other) stipulations shall apply: In provisions (i.) prescribing a maximum price which may be charged by the undertakers in respect of gas; or (ii.) prescribing a standard price in respect of gas supplied by the undertakers and providing for variations in the rate of dividend payable by them according to the price actually charged by them in respect of gas; or (iii.) prohibiting the undertakers from paying a dividend in excess of a basic rate when the price charged by them to any person in respect of gas has equalled or exceeded a basic price or has exceeded a basic price by an amount specified in the enactment; no account shall be taken of charges made by the undertakers in respect of gas under any such agreement [*i.e.*, stand-by supply agreement] or under a special contract.

The first of the miscellaneous provisions of the Bill permits undertakers, upon agreed terms, to give a supply of gas in bulk to, or obtain a supply of gas in bulk from, any other undertakers "through a pipe passing through any point at which the authorized limits of supply of the two undertakers adjoin." No pipe so laid shall be deemed to be a main within the meaning of section 11 of the Gas-Works Clauses Act, 1871, unless gas is supplied directly from the pipe to any person other than the undertakers; but the provisions of the Gas-Works Clauses Act, 1847, with respect to the breaking-up of streets for the purpose of laying pipes, and with respect to the protection of pipes when laid, shall, subject to any variations or exceptions specified, apply in relation to pipes for the supply of gas by the undertakers under an Order made under this section as they apply in relation to pipes for the supply of gas by the undertakers under the enactments applying to them before the making of the Order.

The Bill includes provisions for the abolition of the offices of Chief Gas Examiner and Gas Referees, the appointment of Gas Examiners, &c.; but we do not notice any reference to the fixing of a minimum charge to consumers.

Non-Statutory Undertakings

THE clauses in the Bill which apply to non-statutory undertakers and undertakers other than "thermal unit" undertakers, are three in number, and also deal with matters raised by the Gas Legislation Committee in their final report. The Committee, it may be remembered, expressed the opinion that the interests of the Gas Industry and of consumers in general would best be served by the incorporation in legislation of a provision whereby the Board of Trade would be required, at any time after two years from the passing of the Act, and within the three following years, to make a Special Order conferring statutory powers and imposing the usual statutory obligations on any undertakers who, during the year preceding the making of the Order, supplied more than 30 million c.ft. of gas. Such an Order, they said, would need to apply the provisions of the Gas-Works Clauses Acts to the undertakers affected, and would need to contain the usual provisions incorporated in Private Acts and Orders regulating capital, price, and dividend.

The Bill provides that, where it appears to the Board of Trade that any non-statutory undertakers have in the year 1934 or any subsequent year supplied more than 30 million c.ft. of gas, they may, at any time after the end of the first of those years in which the undertakers supplied more than that quantity of gas, and shall before the expiration of the next two following years, serve upon the undertakers a notice under the section—provided that no such notice shall be served before Jan. 1, 1936, and the Board shall not be required to serve such notice before Jan. 1, 1938. The meaning of "a notice under the section" is explained below.

If, on an application made by a local authority at any time after Jan. 1, 1939, it appears to the Board of Trade that any non-statutory undertakers supplying gas within the area of the applicants supplied more than 20 million c.ft. of gas (whether within the area of the applicants or not) in the year preceding the application, and that the supply of gas maintained by the undertakers within the area of the applicants in that year was insufficient or otherwise unsatisfactory, and that at the date of the application no sufficient steps had been taken to remedy the matter, the Board shall serve upon the undertakers a notice under the section.

This "notice under the section" of the Bill shall require the undertakers within six months from the date of the notice to make an application to the Board of Trade for a Special Order containing provisions authorizing the undertakers to manufacture and supply gas within the limits specified in the Order, applying to the undertakers the provisions of the Gas-Works Clauses Act, 1847, and of the Gas-Works Clauses Act, 1871; requiring the undertakers to charge for gas according to the number of British thermal units supplied; and regulating the capital of the undertakers and the dividend payable by them and the price to be charged by them for gas.

If any non-statutory undertakers upon whom a notice has been served under the section fail to make an application as required by the notice or withdraw or fail to proceed with the application or submit an Order which is not approved by the Board of Trade, the Board shall themselves prepare a Special Order containing the provisions required by the notice and such other provisions (being provisions which the undertakers could have included in an Order submitted in pursuance of the notice) as the Board may think necessary or expedient, and shall send to the undertakers a copy of the Draft Order prepared by them and take steps to make the Order as if the undertakers had applied for it to be made.

Where a notice under the section has been served, the Board may require the undertakers to furnish such returns and other information relating to their gas undertaking as the Board may think necessary, and may authorize an inspection of any works used by them for the purpose of their undertaking. Non-compliance shall, for each offence, render the undertakers liable on summary conviction to a fine not exceeding £20, and a further fine of £5 for each day during which the default continues.

As from Jan. 1, 1939, gas supplied by non-statutory undertakers or undertakers who are not "thermal unit" undertakers is to be subject to the usual conditions as to purity and pressure, provided that where any non-statutory undertakers have not supplied more than 20 million c.ft of gas in any of the five years immediately preceding that date the requirement as to purity shall not apply until the end of the first year after the date named in which they supply more than this quantity of gas.

All non-statutory undertakers are to furnish to the Board of Trade before March 1 each year a return showing the quantity of gas supplied in the last preceding year—under liability on summary conviction to a fine not exceeding 40s. for each day during which the default continues.

A Midsummer Competition

ON a later page we publish particulars of a competition which is being organized by Messrs. West's Gas Improvement Company, Ltd., and which should arouse a great deal of interest. The firm are to devote the Summer Number of their house organ, *West's Gas*, to an "article competition," in which prizes will be given for the best articles submitted. The articles will be limited to 4,000 words, *but mere length will not be accounted a virtue.* The phrase italicized appeals to us very much indeed. The subjects chosen—Coke, Technical Control of Gas-Works, Industrial Gas, Gas in the Home, and Tar—cover a wide field and afford ample scope; and the prizes offered provide plenty of encouragement. In each section two prizes are offered, one of 20 guineas for the best article and one of 10 guineas for the second best—150 guineas in all, apart from "consolation prizes." Mr. George Evetts has consented to act as judge, with the

assistance of such specialists as may be deemed necessary. The competition is a commendable gesture on the part of West's Gas Improvement Company, who are to be complimented on their public spirit, which merits a warm response. We hope and believe that the number of entrants—and the competition should appeal especially to the younger members of our Industry—will be large.

Benzole from Vertical Retort Gas

THOUGH several undertakings are profitably recovering benzole from gas produced in continuous vertical retorts, many others may still be weighing up the pros and cons of such a course. Those so situated will find of great value a contribution by Mr. C. H. Chester, General Manager and Secretary of the Swindon United Gas Company, which appears in the "JOURNAL" to-day. At the Swindon Works the carbonizing plant consists of three beds of Glover-West continuous verticals, and the author is recovering benzole from the gas produced. Besides a substantial profit from the benzole plant *per se*, there are many ancillary advantages which should be noted carefully. Mr. Chester certainly makes out a strong case.

With a good coke market, such as exists at Swindon, the extra amount of coke made not only produces revenue, but engenders goodwill. Washing for benzole implies more retorts in operation for the same standing charges, and in many instances without additional labour. At Swindon the greater throughput of coal is being dealt with by the same number of operators. "Apart from the welcome effect on the balance-sheet," observes Mr. Chester, "the most noteworthy feature of the plant is its very convenient flexibility. In the same way as it could if necessary be used to smooth out fluctuations in the load curve, it can be used in times of emergency or sudden demand in a way that is extremely gratifying. We have been obliged at times to close down the plant for short periods during peak demands due to sudden fog, cold snaps, &c. In the same way it is a useful safeguard against the various minor accidents met with occasionally, as, for example, a bad patch of coal. The thermal reserve is usually sufficient to cover the bad period."

Recovery of benzole is now such a trouble-free process, and brings in its train so many advantages, not the least of which is a reduction in the sulphur compounds in the gas supplied to the district, that Mr. Chester's experience of stripping benzole from vertical retort gas should go far to extend a process which has won such favour among engineers having horizontal retorts or intermittent chamber ovens.

A Successful Experiment

As we were going to press with our Special B.I.F. Number last week we received from Mr. J. T. Haynes, Engineer and Manager to the Rotherham Gas Department, information of first-class importance regarding the results of an experiment in gas charges. Eighteen months ago the Committee gave a trial to a two-part tariff consisting of a service charge ranging from 10d. to 2s. according to the type of house, and a commodity charge of 10d. per 1,000 c.ft. to ordinary consumers and 1s. to prepayment consumers. The experiment has proved an unqualified success—as, indeed, we anticipated it would—and the Rotherham Council have now confirmed the Gas Committee's recommendation to make the two-part tariff available to all domestic consumers.

The Rotherham method of charge means that gas is sold at a price to compete with any other fuel for heating and water heating; that the price is all right for cooking goes without saying. Figures were set out in the "JOURNAL" last week showing how popular the multi-part tariff has proved to the consumer, and how profitable to the Gas Department. That all-important increase in consumption per consumer has been attained with substantial financial benefit to the supplier. With 134 consumers (80 prepayment, 54 ordinary) under trial, the average consumption per consumer grew from 15,600 c.ft. in 1932 to 50,500 c.ft. in the twelve months January-December, 1933—the revenue per consumer from £2 13s. 7d. to £4 7s. 2d. The net revenue of the Department increased by £108. It may be argued, and with justification, that Rotherham is unusually fortunate in being able to purchase coke oven gas so cheaply, but it is the progressive sales policy of the Department which has gained so much ground for gas. There is no doubt about it that a multiple tariff system provides a real incentive to the consumer to increase his use of gaseous fuel.

Gas in Industry

THE idea of supplying gas to the industrialist is fortunately for our Industry giving place to the idea of applying gaseous heat in the manufacturers' premises in a manner which will ensure his satisfaction, which implies, of course, his profits. The mere piping of gas is only a start in the chain of service, recognition of which fact has led to the institution of industrial development centres throughout the country where research in industrial gas utilization is in constant progress. Significant of the changed attitude is the paper which Mr. Peter Lloyd, of the Gas Light and Coke Company, gave to the London and Southern District Junior Gas Association. A lengthy extract from the paper is published in this "JOURNAL." The author deals with some of the underlying principles of the application of gas to industrial processes. His treatment of what admittedly is a complex subject is refreshingly clear, and what he has to say should be of great assistance to all who are faced with industrial heating problems and are designing equipment to employ gas to the best advantage.

Mr. Lloyd indicates the right approach in tackling these problems, concerning himself particularly with thermal efficiency and the factors which influence it. Where several different fuels are in competition thermal efficiency is, of course, a primary consideration. Fuels are available which are greatly cheaper than town gas and which, apart from considerations of efficiency and convenience, would normally be preferred to it. And, as the author emphasizes, it is only by maintaining its efficiency and convenience in advance of these other fuels that gas is able to exist in competition with them. It is for this reason that there has been such a great drive in recent years to increase the efficiency of gas-fired appliances, and remarkable improvements have been effected. In a number of processes it has been found possible to reduce the gas consumption by fully 50% by using up-to-date equipment, and in some cases even greater economies of fuel have been obtained. If to-day manufacturers are using inefficient gas appliances—and we are not wrong in saying that much obsolete apparatus is yet in use—it is the fault of gas undertakings. This uneconomical equipment is an open door to our competitors; and we hope that Mr. Lloyd's paper will concentrate thought on modern gas utilization in industry. It certainly indicates what modern gas utilization implies.

Correspondence

Washing of Gas.

SIR,—In your report (p. 496 *et seq.*) of the discussion on the papers of Mr. Hollings and myself on the Washing of Gas, you have omitted my reply to Dr. Underwood's remarks concerning the application of equation 17 of the first paper, the essence of which was as follows:

In the example given by Dr. Underwood the quantity of washing liquid is less than the theoretical minimum required to wash the gas to the given slip. This minimum is defined in an earlier section of the paper.

Since the result assumed is thus impossible under the conditions given, any attempt to apply the equation to this example is bound to give an "imaginary" result.

Yours, &c.,
L. SILVER.

Gas Light and Coke Company,
Engineer's Department,
Westminster, S.W. 1,
Feb. 26, 1934.

THE NEWS OF THE WEEK

European Gas Company, Ltd.—The Board of the European Gas Company have decided, subject to audit, to recommend a final dividend for the year 1933 at the rate of 3½%, making 6% for the year, free of income-tax. This dividend is the same as for the year 1932.

Lurgan Urban Council has received from the Ulster Ministry of Finance the second instalment (£5,000) of a £17,000 loan granted for improvements at the gas-works. The gas-works showed a net gain for the year of £109, as compared with a loss of £604 in the previous year.

The Expansion of the Area of Supply of the Watford and St. Albans Gas Company was mentioned at the annual meeting of the Company last week by the Chairman and Managing Director (Mr. F. H. Jones), who said that the purchase of the Rickmansworth Urban District Council's gas undertaking was now awaiting the approval of the Board of Trade and both Houses of Parliament.

Six Price Reductions in Two Years.—It has been decided by the Directors of the Kennoway and Largo Gas Company to reduce the price of gas by 3d. per 1,000 c.ft., this having been rendered possible by the steady increase in consumption. This is the sixth reduction which the Manager, Mr. E. L. Farquhar, has effected during the past two years. It has also been arranged to alter the setting of slot meters, so that the full amount of gas per coin will be received, thereby doing away with any rebate.

An Official Return just to hand shows that 13,556 tons of gas heating and cooking stoves and apparatus, valued, taking the Dutch guilders at 12 to the £, at £377,500, were imported into Holland during last year, as contrasted with only 11,431 tons and £343,750 in 1932. Of the total 9,915 tons are credited to Germany, 3,294 tons to Belgium, 116 tons to France, 94 tons to Sweden, and only 73 tons to Great Britain. As regards the exports of similar goods from Holland, although these increased in quantity from 286 tons in 1932 to 291 tons last year, the value of the shipments declined from £13,665 to £12,330. Of the total 144 tons were shipped to Belgium, 108 tons to Germany, and 21 tons to France.

At an Extraordinary Meeting of the proprietors of the Plymouth and Stonehouse Gas Light and Coke Company, held at the works at Coxide on Feb. 15, the Chairman, Colonel R. L. Norrington, moved a resolution that the Directors be authorized to issue, under the authority of the Plymouth and Stonehouse Gas Order, 1930, £120,000 debenture stock upon such terms as they might determine. He stated that he commented at the last annual meeting on the fact that their capital account was overspent by some £87,000, and that the Directors at a suitable time would take steps to rectify that position by raising fresh capital. The present was a favourable time for making the issue, for which they possessed the necessary powers. The proposition was carried unanimously.

A New Light on Murdoch.

The Scotch God of the Persians, William Murdoch, of Ayrshire, Scotland, inventor of gas lighting, was proclaimed a deity by Shah Naser-ed-din, who believed him to be a reincarnation of "Merdoch," God of Light.

Merdoch was the ancient God of Light venerated by the Assyrians, Babylonians, and Persians. The name is pronounced exactly like the name of the great Scottish engineer, William Murdoch (1754-1839), who is the inventor of coal gas for illuminating purposes. When the Persian Shah Naser-ed-din visited London in 1873, he was greatly impressed by the gas illumination in his suite. He expressed a wish to inspect the gas-works, where he learned to his astonishment the name of the inventor. The King suggested the Scotsman was obviously a reincarnation of the ancient Persian deity of Light. A picture of William Murdoch was carried away by the Shah. It was later enshrined in the royal palaces of Teheran and Kasr Kadjar, and figured as a divinity in the religion of the Suffi sect of Persia.—*From the Magazine of the Philadelphia Gas Office.*

Sir Arthur Duckham Memorial Fund.

Second List of Donors.

The following further list of donors to the Sir Arthur Duckham Memorial Fund has been received from Mr. J. R. W. Alexander, 28, Grosvenor Gardens, London, S.W., the Hon. Secretary and Treasurer to the Fund, and contains the names of the donors between Feb. 21 and Feb. 23 inclusive. Up to the last-named day 96 donors had contributed a total sum of £1,886.

The Right Hon. Lord Ebbisham, G.B.E., has consented to serve on the Committee.

ABERYSTWYTH GAS COMPANY.
Sir JAMES BAILLIE, LL.D., D.Phil., Leeds.
Colonel WILLIAM MONCRIEFF CARR, Stretford.
JACQUES CARTIER, London.
CHANCERY LANE PRINTING WORKS, LTD., London.
DOUGALL'S GAS METERS, LTD., Chiswick Mall.
Mrs. V. E. DUCKHAM, Lingfield.
EAST SURREY GAS COMPANY, Redhill.
ELLAND-CUM-GREETLAND GAS COMPANY, Elland.
GREENGATE AND IRWELL RUBBER COMPANY, LTD., Salford.
JOHN HALLIWELL, London.
Lady HAMBLING, Yoxford.
D. A. HART, Sutton.
W. C. HOLMES & CO., LTD., Huddersfield.
PERCY N. HOOPER, Torquay.
IMPERIAL CHEMICAL INDUSTRIES, LTD., Westminster.
"JOAN."
ERNEST KING, Sheffield.
Viscount LEVERHULME, London.
FRANK LIVESEY, Budleigh Salterton.
R. C. MACDONALD, London.
J. MACLEOD, Glasgow.
NEWMARKET GAS COMPANY.
NEWPORT PAGNELL GAS AND COKE COMPANY, LTD.
J. R. RICHMOND, Glasgow.
SEAFORD GAS COMPANY, LTD.
J. FRASER SHAW, London.
JOHN TERRACE, Sydenham.
WILFRID WASTELL, Lower Sydenham.
The Right Hon. Lord WEIR, P.C., G.C.B., Glasgow.
G. & J. WEIR, LTD., Glasgow.

Radiation Research Kitchen.

Advice on Cooking Problems.

The Radiation Research Kitchen is open during the first week (Monday to Friday inclusive) of each month, when advice will gladly be offered on cooking problems, recipes, and the use of the "New World" cooker, &c.

When making an appointment kindly write to Radiation Limited, Research and Demonstration Kitchen, 15, Grosvenor Place, London, S.W. 1.

Institution of Gas Engineers.

The 71st Annual General Meeting of the Institution will be held in London from June 5-8. The business sessions will be held at the Institution of Civil Engineers, Great George Street, Westminster, S.W. 1.

The Reception and Dance will take place at the Park Lane Hotel, Piccadilly, London, W. 1, on June 5, 1934.

The 6th Autumn Research Meeting of the Institution will be held on Nov. 6-7, at the Institution of Mechanical Engineers, Storey's Gate, St. James' Park, Westminster, S.W. 1.

Bound copies of the Proceedings at the 26th Canadian Gas Convention at Ottawa and at the 15th American Gas Convention of Chicago in 1933, can (by courtesy of the Canadian Gas Association and the American Gas Associa-

tion) be obtained at the special member-price of 12s. 6d. and 6s. 3d. each respectively, if orders (accompanied by the appropriate remittance) are placed with the Secretary of the Institution of Gas Engineers, 28, Grosvenor Gardens, S.W. 1, before March 14. After that date copies (if then available) can only be supplied at non-member-prices.

A Midsummer Competition in Gas.

With a view to fostering an increased interest in some of the principal activities of the Gas Industry, Messrs. West's Gas Improvement Company, Ltd., propose that the Summer Number of *West's Gas* this year shall take the form of a competition in which prizes will be given for the best articles submitted under five headings, generally as follows:

1. COKE.
   Grading and cleaning; weighing and bagging; sale and delivery; applications to domestic and industrial uses; the open fire; central heating, &c.
2. TECHNICAL CONTROL OF THE GAS-WORKS.
   The importance and extent of the application of technology to this purpose; use of scientific methods and instruments; weighing, measuring, sampling, and analysis of coal and coke; observation of temperatures and pressures; analysis of gas and bye-products, records, &c.
3. INDUSTRIAL GAS.
   A general account of the use and application of gas in industry and manufacture; methods of securing the business; planning the sales campaign; construction of tariffs; comparison with other fuels.
4. GAS IN THE HOME.
   Domestic uses of gas; gas-lighting in the home; its possibilities; room-heating; water-heating; central heating; future development; relation between gas and competitive fuels.
5. TAR.
   Factors affecting the quantity and quality of production; tests and analysis; preparation for market; road tars; tar oils; pitch; economics; organization of development and sale.

Articles will be limited to 4,000 words, but mere length will not be accounted a virtue.

PRIZES.

It is proposed to offer prizes of 20 guineas for the best, and 10 guineas for the second best, article under each heading.

Mr. George Evetts, M.Inst.C.E., Consulting Engineer, London, has consented to act as judge, with the assistance of such specialists as may be deemed necessary.

Names of the competitors will not, of course, be given to the judge, and full details of the conditions of the competition will be issued on application.

ENTRANCE.

Entrants for the competition should make application as soon as possible to the Editor of *West's Gas* (or, in the case of competitors resident abroad, to the nearest representative of West's Gas Improvement Company) for a copy of the Rules of the Competition.

The following are the addresses to which overseas entrants should make application:

Canada and America.—Mr. S. J. BEALE, The West Gas Improvement Company of America, Inc., 441, Lexington Avenue, New York.

Australia.—Mr. F. E. BIRD, Messrs. West's Gas Improvement Company, Ltd., P.O. Box 2,717C, Sydney, New South Wales.

New Zealand.—Mr. E. RABBIDGE, 39, Lower Taranaki Street, Wellington.

Europe.—Mr. S. ATHRON, A.M.I.Mech.E., 88, Nieuwe Bossche Weg, Tilburg, Holland.

Scandinavia.—Mr. E. GUNST, Gl. Kongevej 102, Copenhagen, V., Denmark.

The latest date for the reception of competing articles will be June 30, 1934.

The successful articles will be published in the Summer Number of *West's Gas*, which will take the place of the August and September issues. The Editor reserves the right to publish any, or all, of the articles submitted. For any articles which, while not adjudged winners in the competition, are selected for publication, prizes of a nominal amount will be awarded.

Second International Gas Conference.

At the Second International Gas Conference of the International Gas Union, which will be held at Zurich, Switzerland, from Sept. 1-4, 1934, the following Reports will be presented by the undermentioned Nation-Members and discussed:

By Germany: "Co-Ordination of the Methods of Testing and Guaranteeing Gas-Making Plants."
By Belgium: "Methods for the Development of the Industrial Use of Gas, including the Hotel Industry."
By France: "Co-Ordination of Methods of Testing Gas Appliances."
By Great Britain: "Methods for the Development of the Use of Gas for Domestic Purposes."
By Switzerland: "Systems of Carcassing Buildings."
By Czecho-Slovakia: "Systems of Gas Charges."

Advance copies of the Reports will be procurable, price 18 Swiss Francs the set.

ADVANCE PROGRAMME.

The following is the Programme as at present arranged:

Saturday, Sept. 1:
General Meeting of the Swiss Society of Gas and Water Engineers. All attending the Conference are invited.
Evening: Informal Reunion.

Sunday, Sept. 2:
Morning: Second International Gas Conference (opening).
Afternoon: Trip on the Lake.
Evening: Official Dinner.

Monday, Sept. 3:
Second International Gas Conference (continued).
Evening: Visit to the Opera.

Tuesday, Sept. 4:
Morning: Second International Gas Conference (concluded).
Afternoon: Visit to the Gas-Works, Zurich.

Wednesday, Sept. 5:
Visit to Lugano (optional).

REGISTRATION.

Participation in the Conference, including an advance set of Reports, the Trip on the Lake, Official Dinner and Opera, but excluding the optional Visit to Lugano, will cost 35 Swiss Francs each, or, for the members of a delegate's family, 20 Swiss Francs each, excluding a set of Reports. The Foreign Exchange rate at present approaches 16 Swiss Francs to the £.

Further information and copies of the Advance Programme and Provisional Registration Form can be obtained by those interested from the Secretary of the Institution of Gas Engineers, who hopes to make special travel and hotel arrangements for those members of the British delegation intimating, when definite registration is called for, their desire to participate in such facilities.

It is anticipated there will be a large delegation from Great Britain, having in mind that the International Gas Union was inaugurated at the 1st International Gas Conference, held in London in 1931, under the auspices of the Institution of Gas Engineers, the President of which and other members of the Council will attend the 2nd International Gas Conference in Zurich. Mr. Harold E. Copp (Past-President, the Institution of Gas Engineers) is a Vice-President of the International Gas Union and is a member of its Council, as is Mr. J. R. W. Alexander (Secretary of the Institution).

Mr. A. Roberts Addresses Hereford Rotary Club.

Mr. A. Roberts, Manager of the Hereford Corporation Gas-Works, gave an address to the members of the local Rotary Club on Feb. 19, his subject being "The Growth and Development of the Gas Industry."

In the course of his address, Mr. Roberts said that the progress of the Industry had been very marked over the last 20 years. In 1923 the total gas made was just over 210 million c.ft.; last year it was 330 millions. Similarly the proportionate consumption of gas per consumer had increased considerably, showing its ever-growing popularity. He quoted figures to show the huge size of the Industry in the British Isles and the amount of labour it employed, this having an annual wage roll of 15 million pounds.

The man-in-the-street, said Mr. Roberts, did not always realize the many uses to which gas was put. It was used

in undertakings ranging from metal melting to cremation. It played no small part in the war, having supplied enough explosives to charge and fill 160 million 18 pounder shells as well as quantities of fuel oil, disinfectant, and road tar, the last three products being still in active supply.

In 1880, in Hereford, 60 million c.ft. of gas was made. By 1913 the figure was 153 millions, and it had reached 239 millions for last year. For its size the local industry ranked high in the list of consumption per consumer. The local gas department now had on hire 5,323 cookers, 2,549 fires, and 1,330 boilers and geysers, while the gas was distributed through 53 miles of mains.

The speaker then described the improvements that had been made in lighting and heating, so that greater power was given for less consumption, and the designs of the appliances made were not only more efficient, but more attractive.

Successful Gas Exhibition at Plymouth.

One of the most successful Gas Exhibitions ever held in Plymouth has just concluded, having run from February 12th to 23rd with every dav crowded with interest. The success of this event was not surprising; it reflected careful preparations, much originality and foresight, and excellent staff work from start to finish. The exhibition was staged in the Abbey Hall, which, being situated in a busy and central position in the town, revealed a wise choice. The ground was well prepared for some weeks prior to the event. Bold announcements appeared in solus positions in the local Press, and these advertisements were continued during the run of the exhibition. Every gas consumer in Plymouth received a special pamphlet (enclosed with the gas account) entitled " A Fortnight to Remember." This announced the exhibition in a striking and novel way and served to fix the dates firmly in the mind of every housewife. Each home also received a full programme of the fortnight's activities, which included cookery demonstrations twice daily by Miss D. J. Baker, M.C.A. (of Radiation Ltd.), and Miss K. Jenkin, who is on the Gas Company's staff.

The showroom window displays of the Plymouth and Stonehouse Gas Light and Coke Company were also arranged to link up with the exhibition and draw attention to it. The general colour scheme adopted for the exhibition lay-out was pale blue and primrose yellow. This combination presented a most clean and pleasing background for the various exhibits, all of which were grouped into sections, each " bay " being devoted to a particular type of apparatus. The stage was set out in a thoroughly practical and appealing manner for cookery demonstrations, and two Richmonds " Bungalow " " New World " cookers were shown fitted and in operation. Certain of the demonstrations were preceded by a short health talk by Mr. T. Bowen Partington, F.I.L., F.R.E.S. of Lon., and there was also a series of washing and laundering lectures held daily throughout the fortnight. All these events proved extremely popular. For the cookery demonstrations the Hall was invariably crowded to capacity—both in the body of the building and in the gallery also, and the " House Full " notice had frequently to be called into use.

No record was kept of the numbers of people who merely visited the exhibition, but it is known that over 4,500 actually came and stayed to witness the cookery demonstrations during the eleven days. In addition to this the local schools sent their senior girl students in groups of 40 at a time to witness the demonstrations and learn the advantages of " Regulo-controlled " cooking.

Music was provided throughout the day, and after each demonstration light refreshments were served free of charge, and then visitors were invited to examine the display of apparatus tastefully arranged round the Hall. These exhibits included a full range of Radiation " New World " cookers in the familiar grey-mottled enamelled finish and also in the various " Beau " coloured porcelain enamelled finishes. Each purchaser of a " New World " cooker was presented with one of the new Radiation gas matches, and this special " exhibition gift " proved a very helpful sales attraction.

A separate section devoted to gas fires and heating apparatus generally claimed its full share of attention, and the business which resulted was highly satisfactory.

A considerable portion of the space available was given to a very complete water heating display, the exhibit comprising Richmonds " Newlyn " sink heaters, " Don " geysers, " Equator " storage heaters, " Lynmere " storage heaters, and John Wright " K.C.U." heaters. All the gas and water connections were shown in chromium plated finish, and this added to the workmanlike and pleasing effect of the whole effort.

Most of the exhibition display has now been transferred to Plympton, which is one of the outlying districts of Plymouth, and here the local residents are rallying to mark, learn, and inwardly digest the many advantages which modern gas equipment holds for them.

Increased Industrial Business at Newcastle.

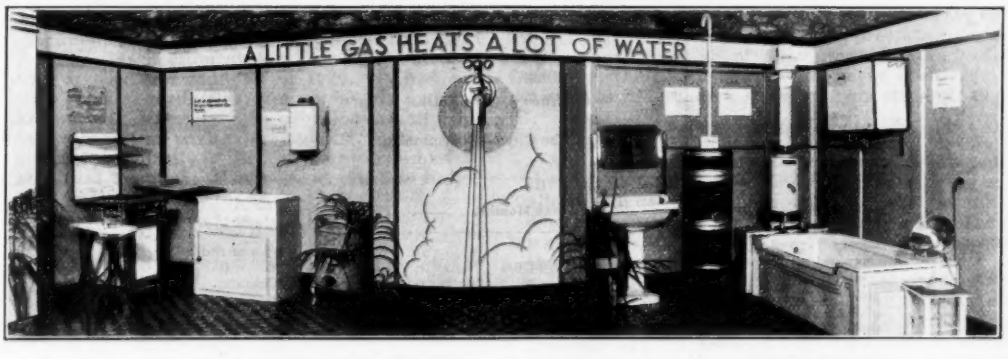
Speaking at the General Meeting of the Newcastle-upon-Tyne and Gateshead Gas Company yesterday, the Chairman (Mr. J. E. Cowen, J.P.) said that the sales of gas during 1933 have just exceeded those of 1932.

The Industrial Sales Department continues to do good work and with the improvement that has recently taken place in shipbuilding and engineering increased consumption of gas in these trades is now definitely showing itself.

He informed the shareholders at the last meeting that the Company had obtained from one customer an order for bread baking and steam raising plant which would represent a consumption of over 50 million c.ft. of gas per annum. This quantity has been reached and every satisfaction given. They have since installed, as a result of the tax upon imported oil, a gas plant for another very large bakery which has the largest gas-fired travelling oven in this country, with an output of 1,200 2-lb. loaves per hour. The whole of the conversion work was undertaken by the Company's industrial staff.

Gas has played an important part in the introduction of a new industry to this country. Sir W. G. Armstrong Whitworth & Co. (Ironfounders), Ltd., have recently commenced at Gateshead to manufacture special alloy steel rolls for rolling mill use, and gas has been installed for the delicate heat treatment associated with the manufacture of these high duty rolls. The large furnace installed for this purpose, together with other new uses for gas in the same works, is expected to require 20 million c.ft. annually. Gas is also to be used exclusively in a plant now in the course of erection at the new works of the manufacturers of Andrews Liver Salts. Here again a consumption of about 20 million c.ft. annually is estimated.

Experiments in conjunction with the Northern General Transport Company in regard to the use of compressed gas in place of petrol for motor 'buses have been continued during the year; many difficulties have been met and overcome, with the result that a gas-driven 'bus is now satisfactorily in regular running service between Newcastle and Blaydon. A National Committee of experts, of which one of the Company's officials is a member, is giving the whole subject very close attention, and the Company are having one of their own lorries fitted for the use of gas in order to obtain wider experience.



A SECTION OF THE HOT WATER DISPLAY AT THE PLYMOUTH EXHIBITION.

THE NEWS—continued.

A Lecture at Paisley.

In a free public library and museum lecture on Feb. 20, Mr. A. S. Nisbet, Engineer and Manager to the Paisley Gas Department, described first the general process of gas manufacture, and spoke of changes in method of detail which the experience of the passing years had brought.

He passed then to detailed description of the plant at the local gas-works, explaining the change from horizontal to vertical carbonization, with its consequent mechanization of much arduous manual labour. The method of coal and coke handling, the extraction of coke from the retorts, and the subsequent purifying of the gas by removal of tar, ammonia, and sulphur compounds were then passed in review. Measurement, storage, and control of town pressure were mentioned. The lecture was finely illustrated by lantern views.

An interesting part of the description of the undertaking's activities was the reference to its financial stability. The net debt is £117,000 and in its long career the Department has paid in contribution to other trusts and to Electricity Department deficits £139,000. So that, but for its generosity the Gas Department would be free of debt, and of interest and sinking fund charges which are to-day costing 9d. per 1,000 c.ft.

The lecture concluded with a strong appeal for the use of British material for British purposes, instead of the unnecessary importation of foreign bitumen and oil.

New Scale of Charges at Portsmouth.

Block-Rate to be Introduced.

A new scale of prices for gas (see Table) will be introduced by the Portsmouth Gas Company, in the case of ordinary consumers as from the first meter reading after March 20, and in the case of prepayment consumers as from the first collection after March 31.

The scale of prices also applies to all areas supplied by the Company outside the city with the addition of the differential prices now being charged.

As regards prepayment consumers, the above scale applies with the addition of the existing charge for meter and installation. Outside the city the usual differential prices will also be charged.

In making this announcement, the Portsmouth Company state that by taking full advantage of their gas supplies all consumers can benefit by the new charges. It is a matter of installing one or more additional gas appliances in the home—that's all. Consumers are invited to take advantage of the opportunity the new scale offers, and secure a cheaper supply of gas. The introduction of this scale, it is added, makes it a real economy to use gas for all industrial and commercial purposes, including central heating and steam raising. At the new prices gas compares favourably with oil and solid fuels, and the advice and help of an expert is always available.

THE ANNUAL MEETING.

In moving the adoption of the report and accounts at the Annual Meeting of the Portsmouth Gas Company, the Chairman, Mr. T. H. F. Lapthorn, J.P., stated that a dividend was recommended of 5% on the 5% maximum stock and 8% on the consolidated stock, both less income-tax, for the year ended Dec. 31 last. The amount carried forward after payment of the dividend would be £35,589. On the revenue account, the receipts for the sale of gas were down by £8,576. Receipts from the sale of coke were less and the price was lower. They produced 86,000 gallons less of tar, and this accounted for another drop, but the outlook for tar was better now than it had been for some years, owing to the fact that many surveyors who previously had been buying bitumen exclusively had been experimenting during the past year with tar and tar compounds with very satisfactory results. They used 900 tons of coal less during the past year and 157,592 gallons less of oil.

Repairs and maintenance of works and plant cost £88,950, an increase of £15,571, due to the extra cost of the new installation at Hilsea. Repairs, renewals, and fixing of hired appliances showed a drop of between £12,000 and £13,000. The result of the year's trade was a profit of £72,376, compared with £74,568 in 1932, a result which they considered perfectly satisfactory. Their consumers had increased from 71,340 to 72,989 at the end of 1933, and the new installation at Hilsea would enable them to send out 11 million c.ft. of gas or sufficient to meet one day's claims without having to call upon their other works.

Dealing with the question of prices, Mr. Lapthorn stated that for some time they had felt that their method of charging a flat-rate with a discount varying with the consumption could be improved, and they had decided to scrap it and introduce a new system outlined above.

Reference was made by Mr. T. Carmichael (Engineer and General Manager) to the fact that the Chairman of the Company would complete 25 years in that office on March 18, and that in celebration of that occasion the employees were inviting Mr. Lapthorn and the other Directors to a dinner at the Portsmouth Guildhall on March 19. There were over 1,000 men, and as they could not all take part at once, 700 men would gather at the Guildhall on this occasion and the other 300 odd would meet Mr. Lapthorn on another evening.

South Western Gas Corporation.

At the annual meeting of the St. Austell Gas Company, Ltd., the Chairman, Mr. S. J. Ingram, referred to the offer of the South Western Gas Corporation, Ltd., to purchase the old (£2) shares, yielding 8½%, at £3 15s. per share, and the new (£2) shares, yielding 7½%, at £3 2s. per share.

Mr. Ingram said that for some time past the tendency in industrial circles had been in the direction of amalgamation of companies, or grouping of units, for the purpose of more efficient working and defence against competition. On the one hand they had industries fostered and encouraged by Government, and on the other more intensive competition from other interests. These tendencies had made it increasingly difficult to operate the smaller gas undertakings, making it desirable that they should link up with larger undertakings or merge in some holding company. He said the Directors felt justified in themselves accepting the South Western Gas Corporation's offer, and in recommending the shareholders to follow suit. He pointed out that those who accepted the offer could take their purchase consideration either in cash or shares.

We learn from the *Financial Times* that the Corporation is making an offer to purchase the ordinary stocks or shares of Truro, Camborne, St. Blazey, Bude, Okehampton and Padstow, and St. Columb Gas Companies, as well as the St. Austell Company.

The Corporation will place at par up to 126,000 shares, either ordinary or preference, to provide funds for the acquisition of the above-mentioned stocks in the cases where the purchase consideration is to be paid in cash. Shares will be exchanged in some cases. Formation and issue expenses and working capital will be provided for by the issue of 24,000 £1 ordinary shares at par.

The capital of the Corporation is £600,000 in 200,000 4½% redeemable preference shares and 400,000 ordinary shares.

Ordinary Consumers

(Within the City of Portsmouth).

Based on Consumptions over a Period of Three Months.			First 20,000 C.Ft., *i.e.*, 90 Therms.	Remainder at *One* of the Following Prices.
Scale 1	Consumption up to 20,000 c.ft (90 therms)		7d. per therm	*Nil*
,, 2	Over 20,000 and up to 50,000 c.ft. (90– 225 therms)		7d. ,,	6¼d. per therm
,, 3	,, 50,000 ,, 100,000 ,, (225– 450 ,,)		7d. ,,	6d. ,,
,, 4	,, 100,000 ,, 250,000 ,, (450–1,125 ,,)		7d. ,,	5⅝d. ,,
,, 5	,, 250,000 ,, 500,000 ,, (1,125–2,250 ,,)		7d. ,,	5¼d. ,,
,, 6	,, 500,000 ,, 1,000,000 ,, (2,250–4,500 ,,)		7d. ,,	5d. ,,
,, 7	,, 1,000,000 ,, 1.250,000 ,, (4,500–5,625 ,,)		7d. ,,	4⅝d. ,,
,, 8	,, 1,250,000 c.ft. (5,625 therms)		7d. ,,	4½d. ,,

THE JUNIOR ASSOCIATIONS AT THE FAIR

Mr. C. Valon Bennett's Address at Luncheon

Members of the Junior Gas Associations from all quarters of the country converged upon Castle Bromwich on Thursday of last week, when they were entertained at luncheon at the kind invitation of the Birmingham Chamber of Commerce, and spent a most interesting day inspecting the exhibits at the British Industries Fair.

Mr. J. PERCY PLANT (Chairman of the Journal and Publicity Committee) presided at the luncheon, at which were also present at the top table Mr. C. Valon Bennett (Senior Vice-President of the Institution of Gas Engineers), Mr. R. J. Milbourne, Mr. A. W. Smith (General Manager and Secretary of the Birmingham Gas Department), Mr. W. L. S. Spinks (Hon. Secretary of the Gas Industries Section of the Fair), together with other officers of the Junior Associations and of the Management Committee of the Fair.

A TRIBUTE TO THE JUNIORS.

The Loyal Toast having been duly honoured, Mr. PLANT proposed the toast of "The Gas Industry." He had a very pleasing duty, he said, to extend to them on behalf of the Board of Management of the Fair a very hearty welcome.

A GENERAL VIEW OF THE JOINT INDUSTRIAL GAS EXHIBIT AT THE CASTLE BROMWICH SECTION OF THE FAIR.

They were delighted to see the members of the Junior Associations there, and he hoped their visit would prove beneficial. They were also very pleased to have Mr. Valon Bennett with them. He went on to pay tribute to the Junior Associations, because he knew them to be very business-like bodies, and the only time when they endeavoured to combine pleasure with business was when they made their annual pilgrimage to the British Industries Fair. And they could have no better opportunity during the whole year of getting themselves abreast of the developments in the Industry. The Gas Section at the Fair had increased each year since it was first founded in 1928. It had improved immensely as regards the general lavout and the display of the individual stands. As a business man himself, Mr. Plant said he was particularly glad to notice that the Gas Industry—essentially a British Industry—had so fully recognized that technical advancement must be linked with advancement in selling methods.

MR. VALON BENNETT RESPONDS.

Mr. C. VALON BENNETT (Senior Vice-President of the Institution of Gas Engineers), responding to the toast of "The Gas Industry," said: In rising to thank you for the manner in which this Toast has been proposed, I ought to explain why *I* am now on my feet.

Owing to a very large number of engagements, the President of the Institution of Gas Engineers cannot be here to-day. I am to tell you, from him, of his disappointment, for he appreciates the enormous value of such a gathering as this.

The Institution, knowing the importance of the Junior Gas Associations, desires at all times to keep in touch with and be of assistance to those Associations, and, to show that is so, I, as Senior Vice-President, am here to represent the Institution in Mr. Tarratt's absence.

Now, Sir, not only do I have to thank you for the generous and inspiring way in which you have proposed the toast, and I can assure you we do all appreciate it most highly, but I have other duties to perform, all of which must be crowded into 15 minutes.

First, I have to express our gratitude for the hospitality showered upon us in making us guests at this Luncheon. For this please accept our best thanks.

Secondly, I must say that we value very highly all you have done and are doing to make this day a great success. The busy man, such as we know you are, always makes time to do any "extra job" whenever he can aid others. Will you, therefore, accept our very hearty thanks for all you have done and will you please feel that, although my remarks may have been feeble, our hearts go out to you in gratitude.

Thirdly, may I say how glad we are to be allowed to sit in company with various members of the Fair Committee and the overseas visitors, also some of the chief officials of the Birmingham Corporation Gas Department.

Fourthly, may I be allowed to offer my heartiest congratulations to the organizers and exhibitors of this great Fair. Its size is too great to appreciate in one visit; but it is representative of this great England of this great Empire, the like of which has never been seen before and which, have no fear, will go on from strength to strength.

THE JUNIOR ASSOCIATIONS.

And now I must pass to some words devoted mainly to the Junior Gas Associations, but before doing so may I be allowed to say this. If I have failed to thank anyone to whom our thanks are due, it is because their name is legion, and will they please rest assured our cup of gratitude is full to overflowing.

I do not think we need look for inspiration when we remember we all are connected, in some way or another, with the Gas Industry—to my mind the greatest Industry in this country. When I say "greatest," please do not think I am referring to the capital invested in it, for, although it is large, it is not so great as some other industries; but I

A SECTION OF THE GAS INFORMATION BUREAU AT THE BIRMINGHAM SECTION OF THE B.I.F.

Miss Barratt is seen at work on one of her lightning sketches.

mean it is great because it affects almost every industry and every human being. Seeing that it is of such vital interest to everyone, I wonder why we are not allowed to pursue our business in a manner which would enable us to render even greater service than we do to-day. It is true legislation has, during recent years, removed some of the obstacles (and how we have welcomed relief!), but we are still shackled by antiquated laws and regulations.

It is beyond my comprehension why those who frame the laws of this country can find time to pass legislation to assist and bolster up an industry which, without national aid in every shape and form, was unable to make really great headway; and yet they cannot find time to free encumbrances from the greatest fuel industry the world has ever known, and by this I mean our Industry. We have, like Mr. Micawber, been "waiting for something to turn up," but hope deferred maketh the heart sick. However, during recent years we have made enormous progress, and it is up to everyone of us to pull our weight in the boat and add still more laurels to the crown we have rightly worn for so long.

Fair Competition.

It is a matter of congratulation that we have not suffered that depression which has for so long hung over this country, and it is a great joy to know we have done much to stem and turn the tide, for trade generally is improving. It is, however, a slow business, which we feel would be hastened if we were able to compete upon fair terms with another industry which has been the spoilt child of politicians. We do not fear competition, but it must be fair competition. Give us the chance, and if we fail we can blame nobody except ourselves; but I do not doubt the result.

The chief trades of this country are dependent upon cheap supplies of fuel in some form or another. There is a cry of "Back to Coal!" but it should be "Back to Coal through Gas!" The supplies of coal in Great Britain may be sufficient for many, many hundreds of years, but there is no reason why they should be wasted by being consumed in a raw state. There is no need for me to tell you of the vast number of materials which can be recovered from coal when it is carbonized at gas-works, but I wish the public would realize it more fully. Millions of gallons of oil are brought from foreign countries and paid for with English money when there is practically no need for it, provided that coal is carbonized in this country instead of being used as crudely as it is now.

It has been my misfortune to be in London on many occasions when that vast city has been enveloped in a blanket of dense and foul fog. We cannot prevent fog, but we can, as a nation, prevent fog being foul by prohibiting, as is the case in some of the American cities, the use of bituminous coal in the domestic grate.

The "New Heaven and Earth."

My last experience of a fog in London was not made the happier by all the street lamps in a certain area suddenly being extinguished. As I groped my way, I wondered whether this was a foretaste of the new heaven and new earth everyone has been led to believe will arise as soon as the scheme for defiling and destroying the beauties of our countryside, by the erection of pylons supporting wires for carrying energy from one part of the country to another, has been completed. I remember how grateful I was to come upon some shops which, like the Virgins of old, had kept their lamps trimmed—in the form of retaining their gas lamps—in case the promised millennium never arrived. Like any other person connected with a public utility undertaking, I felt sorry for the suppliers of energy in their trouble; but I could not help thinking that when there is a breakdown at the gas-works the consumer is not affected, because we have taken care to store supplies to be called upon whenever and in whatever quantities the consumer may require. So on I travelled that terrible night until I reached the area where high-pressure gas was used for lighting the streets, and my heart gladdened and I remembered the slogan "Mr. Therm never lets you down."

In addressing you to-day I realize I am speaking to Juniors, but, at the same time, I realize the Junior of to-day is the Senior of to-morrow. You are, or should be, the shock troops to be thrown into the battle; and believe me there is no end to the number of reinforcements which will be required to achieve the victory which must be ours. Are you quite sure you are doing all you can by fitting yourselves for the fight? If so, well and good, but remember you cannot be too efficient. The Industry has a proud record, for it has been guided by men of great experience and understanding, and many of them did not have the educational facilities and opportunities of technical training which you can obtain for the asking.

It was said years ago that profits were made in the retort house, and it is true to-day; but, with the progress of science and understanding, it is equally true that profits are made in every department—distribution, chemical, research, and every form of our activities—provided proper use is made of the science of manufacture, distribution, and utilization of gas; profit not only to the supplier, but profit to the consumer.

A Shining Example.

We are met to-day in this great city of Birmingham, which owns a Gas Department which is one of the shining examples in this country of how a gas undertaking should be carried on, and I should like to be allowed to congratulate everyone connected with it upon its efficiency. Some of you, no doubt, have received assistance from the Birmingham Corporation Gas Department, particularly in regard to the application of gas for industrial purposes. In Birmingham there are, I had almost said thousands of trades, and most of them are using gas for some purpose. We cannot all expect to have such a large industrial load as Birmingham, but you can take it from me it can be much larger than it is at the moment. Every town has some industry where gas can be employed with advantage to everyone concerned. Some of you come from purely residential districts, and perhaps you doubt my word, but just think, just inquire, and you will be surprised how many industries—small perhaps, but still industries—are carried on in your neighbourhood. There is one industry in every town—bread and cake baking. Is gas being used, and, if something prevents it being consumed, is coke being em-

ployed? Are all your fish-fryers, printers, confectionery makers, laundries, and a thousand-and-one other trades using gas? If not, whose fault is it? Do not let any point the finger of scorn at you.

To those of you who are engaged upon research work I say "Be not weary in well doing." You may not be in the limelight all the time, but the results of your labour lighten the burdens of others and make for success in our Industry. So continue with your work with all the will and power that is within you.

The time has come for me to end these somewhat rambling remarks, but I cannot do so without thanking you for the patient hearing you have given me. I feel I have not done justice to the duty laid upon me, but I do say in conclusion that the Gas Industry—faced as it is with every power straining all they can to aid our competitors to make their business a success at whatever cost—has a fight in front of it such as we have never known; so "put on your armour, gird your loins, into the fight, and quit you like men."

Mr. H. C. SIMS (President of the London and Southern District Junior Gas Association) proposed a vote of thanks to the Fair Management Committee for their hospitality and to Mr. Valon Bennett for his most inspiring address. Every member of the Junior Gas Associations, he said, was fully alive to his duties, and the work the Juniors were doing showed they were keeping abreast of modern developments and were equipping themselves for the strenuous times which lay before them.

The vote of thanks was heartily accorded, and Mr. PLANT briefly acknowledged.

Gas Salesmen at the Fair

Friday, Feb. 23, was Gas Salesmen's Day at the Fair, and a large number attended from all parts of the country. The visitors were entertained at luncheon by the Fair authorities.

Proposing the toast of "The Gas Salesmen," Mr. Frank Wain (Hon. Treasurer of the Birmingham Chamber of Commerce), who occupied the chair, said that the British Industries Fair represented almost the ideal method of effecting the objects for which the Circles were formed. There was a unique collection of the latest gas appliances which firms of repute had put on the market. The salesman was able to handle and examine the actual appliance; he heard what the manufacturer had to say about it and at the same time he could discuss it with his colleagues.

"I suppose you all know that I admire you," concluded Mr. Wain. "I have always admired the splendid fight you put up against other forms of power, heat, and light, and the splendid results you get. It is a magnificent fight, and I believe that your Industry is all the better for such fighting."

In responding to the toast, Mr. F. C. Briggs, of Dudley, said the Gas Industry was one to which the Chairman of an important organization of a sister but competing industry had said in his maiden enthusiasm he would deliver the final knock-out blow. In 1798, a mere 136 years ago, gas was first used to light an engine works in Birmingham, and in 1807 the first public supply of gas was in use in London. But was gas showing the signs of senile decay of a centenarian? He suggested that the most modern collective exhibition in the Fair was that of the Gas Industry—and that exhibition merely a sample, a small cross-section of the whole, mainly of the methods of usage. Behind all that was the vast organization of modern factories, modern gas-works with excellent equipment chemically and scientifically controlled to produce a never-failing supply of a constant product.

"What more modern, more cleanly, more useful and drudgery-banishing exhibits are there than those well designed, perfectly automatic cookers, those tastefully designed and beautifully coloured fires, and those up-to-the-moment furnaces specially designed for the purpose in hand, producing certain results without wastage? So modern are they, so quickly do they develop and improve that often—how very often—the user knows little of them and bases his opinions on the past. In this very building quite a short time ago an eminent Birmingham industrialist was gently condemning the gas furnace at a Gas Industry lunch for the very fault of all others—if it had any—which it does not possess at all. And that is why we salesmen exist—to spread the gospel of gas efficiency and gas progress.

"If I may be permitted to mention the Company I know best, the one I have the honour to serve, a Company in the Black Country and therefore in a district facing great industrial difficulties, the sales of gas in 1933 showed a considerable increase over those of 1932 and constituted a record for the Company; the appliances put on the district during the year were more than previously, and the number of consumers reached a new high record.

"To achieve the estimated success of national electrical development, the electricity industry is faced with the immediate and vital necessity of greatly increased consumption. In so far as that consumption is obtained in a legitimate manner, in a nationally and economically sound manner, we wish them every success. But is it to be developed on those lines?

"The development of the Gas Industry has been on economically sound lines. Gas stocks and shares are today, in a time of difficulty, a solid rock for investors. The development of the Gas Industry has been in the national interests. Every therm of gas used has diverted coal from the domestic grate and the factory furnace to the gas-works. Every ton so diverted has produced a greater result in the consumer's house, and in addition the valuable bye-products are conserved for national industries, and the appalling cloud of smoke over our industrial towns has been reduced. We have made a very valuable contribution to the conservation of this country's main natural wealth—coal—a not inexhaustible wealth, be it noted.

"Is the electricity industry developing on the same sound lines? It does not seem so. The necessity for rapid expansion is so vital that there appears to be threatened a definite attempt to capture the business the Gas Industry has already secured. What will be the result?

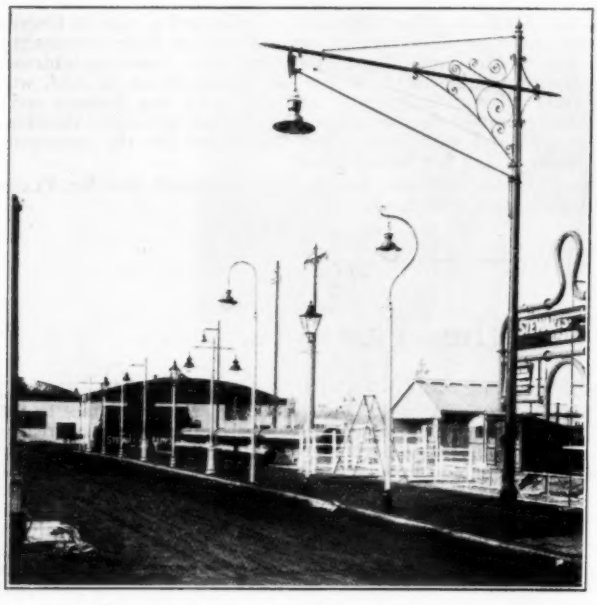
"We wish the electricity industry every possible success in developments for which electricity is eminently suitable, but our motto is—Hands off the business of the Gas Industry for which electricity is definitely unsuited."

Seen at the Fair.

Another solution to the identity of the Loch Ness Monster. He is on the stand of Messrs. Donald Macpherson & Co., Ltd., and represents the latest industrial finishes for gas fires, cookers, and other gas appliances.

All-Steel Poles for Gas Lighting.

In our issue of last week, among the miscellaneous exhibits of interest to our readers at the British Industries Fair, Castle Bromwich, reference was made to Messrs. Stewarts & Lloyds' new all-steel poles for gas lighting. Several examples of these were illustrated (p. 491), but they were referred to inadvertently beneath the illustration as being "cast-iron."



All-Steel Gas Reservoir Poles exhibited at the B.I.F. by Messrs. Stewarts & Lloyds, Ltd.

From the sole plate to the finial every part is of steel.

This improved design of all-steel lighting pole has eliminated all castings—the ornamental bases, the finials, and even the ornamental collars, if these are required, being made of steel. The gas poles shown at the Fair are of the "Reservoir" type, in which the pole itself acts as the supply pipe, but all-steel poles of the ordinary type for use with an internal supply pipe are also available.

Display of Messrs. Gibbons Bros., Ltd., at the Fair.

Rotary Hearth Furnace.

This type of furnace, shown on the stand of Messrs. Gibbons Bros., Ltd., of Dudley, is suitable for heating small parts for various industrial processes, such as gears and crown wheels for motor cars, and carburized parts which will require re-heating prior to quenching.

It can also be employed for re-heating brass billets for stamping and other processes. The unit exhibited was installed for heating nickel chrome steel crown wheels for motor car back axles, and deals with about 20 of these per hour, each wheel weighing approximately 9 lbs. The gas consumed in heating them works out at approximately 2·5 c.ft. per lb. of steel to the required temperature of 800° C.

The main internal dimensions are:

Width of hearth	1 ft. 4 in.
Height of chamber above hearth	8 in.
Diameter of revolving table	4 ft. 9½ in. on the centre line
Speed of hearth	1 revolution in 45 minutes

Where different speeds are required, a variable gear can be attached so that the revolutions can be altered to suit the weight of load in the furnace.

The advantages of the furnace may be summed up: Perfectly uniform heating of the load; definite control of the atmosphere in the furnace; definite control of furnace temperature from 350° C. to 1,000° C.; minimum labour cost; fractional horsepower required for driving; and moderate capital cost.

Great Wigston Gas Order

At the Offices of the Board of Trade in London on Friday, Feb. 23, Mr. J. F. RONCA (Director of Gas Administration) held an inquiry into an application by the Great Wigston Gas Company for a Special Order under the Gas Regulation Act. The Gas Company was represented by Mr. T. G. Seager Berry (Messrs. Sherwood & Co., Parliamentary Agents) and Mr. Alfred T. Harris (Manager and Secretary of the Company). The only opposition to the Order was by the Wigston Urban District Council, which was represented by Mr. W. H. Gunning (Clerk to the Council).

Mr. SEAGER BERRY, explaining the objects of the Order, said that the Great Wigston Gas Company was incorporated by the Great Wigston Gas Act of 1889, and the limitations of supply prescribed in that Act were the then Parish of Great Wigston, now in the area of the Wigston Urban District Council. The existing authorized share capital of the Company was £24,000, the paid-up capital, including premiums, being £22,067. The particular purposes of the Order were to extend the Company's limitations of supply to include some additional small areas in the rural district of Blaby and to authorize the Company to raise £20,000 additional capital. The remainder of the Order contained a large number of general provisions to bring the legislation applying to the Company up to date.

The only opposition to the Order was by the Wigston Urban District Council, which asked the Board of Trade to insert, compulsorily, a clause giving the Urban District Council the option at the end of every five years of giving six months' notice of its intention to purchase the undertaking, the terms of purchase to be agreed upon or determined by arbitration. The promoters, said Mr. Seager Berry, objected to any such proposal for several reasons. In the first place, they were not aware of any case in which such a provision had been inserted in a Special Order, and, moreover, the Company was advised that it would not be competent for the Board of Trade to include such a provision in the Order, without the consent of the Company. Such a clause would give the Urban District Council a right in perpetuity to purchase the Company's undertaking, the date at which such purchase should take place being left in the hands of the Urban District Council. Such a position, it was contended, would seriously hamper the operations of the Company, and retard the proper development of it, and therefore it was submitted the clause would not be in the public interest.

It was pointed out that there had only been two cases of compulsory purchase clauses since 1910 and no cases since 1914. On the other hand, since 1910 there had been five cases in which urban district councils had asked for purchase clauses, but they had all been refused by Committees of Parliament. There were, of course, a large number of cases in which purchase clauses had been inserted in Parliamentary Bills by agreement. Speaking of Special Orders, it was also pointed out that, while there had been a number of cases in which purchase clauses had been inserted by agreement between the parties, there had been none in which a compulsory clause had been granted.

Mr. *Alfred Thomas Harris* (Manager and Secretary of the Great Wigston Gas Company for the past seven years) said there had been no complaints either from the Council or from the consumers as to the quality of the gas or as to the management of the gas undertaking. Speaking of the effect of such a clause as that proposed, he said it would definitely retard the Company in developing the undertaking to have a purchase clause, capable of being acted upon every five years, hanging over their heads.

The DIRECTOR at this point mentioned that the Board of Trade had received a further letter from the Great Wigston Urban District Council asking that in the event of the compulsory purchase clause not being granted, a clause should be inserted compelling the Company to give the first offer of the sale of the undertaking, should it decide to sell at any time, to the Great Wigston Urban District Council.

Mr. SEAGER BERRY said the promoters could not agree to such a restriction being placed upon them.

Mr. W. H. GUNNING (Clerk to the Wigston Urban District Council) then addressed the Director on the lines already indicated, emphasizing the point that the Council had taken up this matter in a perfectly friendly attitude towards the Company, agreeing that the Company had carried out its work, particularly during the past two or three years, quite satisfactorily. He added, however, that on several occasions since 1889 negotiations had been carried on with the Company for the sale of the undertaking, but it was impossible to agree upon terms.

Mr. SEAGER BERRY submitted that the negotiations which had taken place in the past had no possible bearing upon the present Order.

Economic Use of Surplus Coke Oven Gas for Public Purposes*

By Thos. Biddulph-Smith, F.C.S., Assoc.M.Inst.Gas E.

The economical use of coke oven gas by gas undertakings has in recent years increased to a very great extent in this country. In 1921 there were 14 purchasing undertakings taking 1,325 million c.ft. of coke oven gas; in 1932, 32 undertakings took 15,441 millions.

It will be of interest to mention here that, if and when the history of this development is written, the names of two of your members, Messrs. H. E. Wright and C. F. Blincoe, will appear among the most prominent of its pioneers, since in the earliest days they struggled against prejudices, and with unsuitable plant, in this town of Middlesbrough, to prove to the world the advantages to be obtained both by the coke oven industry and the gas undertakings, when using such gas to replace that originally manufactured by the Corporation.

The difficulties met with by early workers in this country using unsuitable plant originally designed solely for coke production, led to many adverse criticisms. Naphthalene was, perhaps, the most troublesome factor, and the difficulty of maintaining a constant calorific value was not far behind, but modern developments have now completely eliminated these troubles. Naphthalene can easily be removed to a figure unlikely to cause stoppage of mains under reasonable atmospheric conditions, and the present use of self-sealing doors making metal to metal joints, together with the inclusion of pressure control governors on the collecting mains, have overcome the difficulty of maintaining a gas of constant composition.

In connection with the latter it is interesting to note the difference in analysis of coke oven gas sent to gas undertakings from two plants in Yorkshire, one being an old-type plant, and the other of modern design.

—	New Ovens.	Old Ovens.
Calorific value	550 B.Th.U. c.ft.	510 B.Th.U./c ft.
Analysis after purification—	%	%
Carbon dioxide	2·90	3·80
Oxygen	0·50	0·40
Unsaturated hydrocarbons	3·10	2·60
Carbon monoxide	7·80	7·40
Hydrogen	52·70	45·30
Methane	28·20	28·50
Nitrogen	4·80	12·00
Total inerts	8·20	16 20

The reduction in the amount of inert gases is very marked in the case of the modern ovens, resulting in the yield of very high quality gas. It will be seen, therefore, why, wherever such gas is available, it is being eagerly sought.

At the Beckton Works, the Gas Light and Coke Company has erected its own coke oven plant for the supply of coke oven gas.

In other countries, particularly in Germany, development in this direction has progressed much further than in Great Britain. In America the tendency is to employ more and more coke oven gas, while in Germany the Ruhr Gas Corporation has been in existence for many years and has a network of high-pressure mains estimated to-day at 620 miles in length.

To a lesser extent "gas grids" are being developed in Belgium and other Continental countries.

The proposed network of mains considered by the Area Gas Supply Committee covers an area of 15 miles square, and it is interesting to note that the estimated cost of this fairly large scheme is:

	£
Mains	232,800
Laying of mains	241,700
Compressors	63,400
	£537,900

The cost of distribution (excluding compression) is estimated to vary from 1·33d. per 1,000 c.ft. with a volume of 40 million c.ft. per day, to 0·66d. per 1,000 c.ft. with a volume of 80 million c.ft. per day.

It is stated in the Report of the Committee that "There is no technical difficulty in the transmission of gas over a network of the size proposed for South Yorkshire," and that the pressures proposed to be used would vary from 2·7 to 8·2 lbs. per sq. in. when the mains are carrying 40 million c.ft. per day, and from 4·9 to 22 lbs. per sq. in. when they are carrying 80 million c.ft. per day.

* From a paper before the Cleveland Institution of Engineers, Feb. 5, 1934

The report as a whole shows that the Committee, after minutely investigating all the technical and economical evidence for and against, are convinced of the economy to all concerned of any such scheme.

It must be agreed that the most economical advantage can be obtained in the districts in close proximity to the supply, since compression to overcome the resistance of very long mains then becomes unnecessary.

In Middlesbrough, for instance, the gas is boosted to the gas-works at a pressure of only 6 in. water gauge, or, in other words, at the normal outlet pressure of the plant, thus a great saving in power compared with the Ruhr scheme, or even the proposed South Yorkshire project, is effected.

A Gas Grid for Cleveland?

If we take the Cleveland district, however, and consider its possibilities in the direction of a gas grid scheme, we find the position of the coking plants, while particularly suitable for distributing gas to the district, are, due to being in the near proximity of iron and steel works, also suitably placed for supplying their gas for the heating of metallurgical furnaces, &c.; but other considerations arise.

Producer gas of about 140 B.Th.U. per c.ft. can be produced much more cheaply per therm than can coal gas obtained by distillation, and is eminently suitable for the requirements of steel furnaces, &c.; hence coke oven gas in competition with the same, except in special circumstances, is only worth for this purpose a proportionate price to its containable heat units.

It will be seen, therefore, that while surplus coke oven gas in this district, having such an outlet, is worth more than valueless gas produced and blown away in purely colliery districts, where its only use can be for the generation of steam for the colliery, its value is much greater to gas undertakings, and that a fairly considered and arranged price can give equal advantage to both concerns.

Another factor for consideration is that at the blast furnaces there is usually a large surplus of low-grade gas of approximately 100 B.Th.U. per c.ft.

A similar position on the Continent, together with their ever-increasing demand for coke oven gas, has led to the development of what is known as the "compound" coke oven, which, being equipped with the means of heat regeneration of both air and gas, is able to be heated by those and similar low-grade gases, so that instead of only 50-60% of the evolved coke oven gas being "surplus" as is the case with the older "simple" ovens, it is possible to send out all the gas produced.

The author is assured that at present, from the plants in Middlesbrough alone, there is now available, including that supplied to the Middlesbrough Corporation, a supply much more than adequate for all public requirements in this district, all of which is equal in quality to any gas produced for domestic consumption, and that, should the demand develop, this in the course of a short time could be greatly augmented.

The questions arise, therefore—Is such a scheme possible in Cleveland? and, What are the possibilities in such a direction?

There are situated within little distances of Middlesbrough, the following towns which have their own gas undertakings.

The annual production of gas at these undertakings, and the cost of gas per therm to consumers, have been added for contrast.

Gas Undertaking.	Annual Production.	Price to Consumers. Therm
	C.Ft.	d.
Hartlepool	421,634,000	8·25 (gross)
Middlesbrough	1,084,899,000	4·70 ,,
South Bank	109,142,000	12·00 (net)
Stockton	602,993,000	7·38 (gross)

The outstanding point is that in the Middlesbrough district the price of gas of the highest quality is so cheap compared with the others, for which their townspeople have to thank the sagacity of the Corporation technical advisers, who, in 1914, with the courage of their convictions, despite adverse criticisms and the possibility that it might adversely affect their professional standing and remuneration, took an important economic step forward to the great advantage of the municipality by arranging to distribute coke oven gas supplied from the Newport Works of Sir B. Samuelson & Co., Ltd.

This can be demonstrated better if it is shown what the

difference in price per therm between Middlesbrough and the other undertakings, based upon their output, is costing their respective districts.

——	Declared Calorific Value.	Price per Therm.	Price per 1000 C.Ft.	Excess over Middlesbrough per 1000 C.Ft.	Excess Calculated to the Annual Output.
		d.	s. d.	s. d.	£ s. d.
Hartlepool . .	510	8·25	3 6·07	1 6·57	33,623 18 7
Middlesbrough.	500	4·70	1 11·5	..	..
South Bank. .	400	12·00	4 0·00	2 0·50	11,141 11 7
Stockton . .	500	..	3 7·00	1 7·50	48,993 3 7
					£93,758 13 9

The Borough of Redcar a few years ago started to take coke oven gas, and after an interruption due to the depression in the iron trade will again receive this gas shortly. Had there been a gas grid in existence in Cleveland, as suggested by the author, there would have been no such interruption in the supply of coke oven gas to this progressive Borough.

From the above table it will be seen that the consumers of the Hartlepool, South Bank, and Stockton districts are paying very considerable sums annually which might be very largely avoided if they were to take their requirements of gas from the coke ovens of the district, although owing to difference in local conditions, cost of distribution, &c., the actual figures may differ slightly from those given in the table.

It is well-known that to the cost of manufacture and distribution of gas must be added the amortization charges liquidating original plant capital, and in consequence the full benefit of obtaining a cheap source of supply would not be passed immediately to the consumer, but as a continual scheme of re-modelling and bringing up to date of their plant, which frequently means the borrowing of large sums of money, will then be unnecessary, existing amortization charges can be reduced and spread over a much longer period of time, yielding an immediate partial relief, gradually increasing to the maximum advantages as these are reduced. It would only be necessary to run mains from Middlesbrough to Stockton and Hartlepool, and a linking main through South Bank to Redcar in order to connect up the existing distributing systems with the coking plants.

There can be no doubt that such a scheme would give great financial relief to the gas consumers in Cleveland and also to the basic industry of the district, and at the same time it is fitting that the district where the pioneer work was carried out should be one of the first to obtain the advantages which accrue from such a scheme.

In conclusion, anticipating your forgiveness for doing so, the author would repeat the words taken from the Area Gas Committee's report that "Industry must have cheap gas; the greater the load on gas undertakings the lower are the overhead costs per unit of gas sold, so that if a large market can be attracted by offering cheap gas the effect is to bring down gas prices all round."

Such cheap gas opens up a potential field of demand in any industrial area where in addition to gas cookers and boilers, central heating and bakeries, gas can be used cheaply for many purposes—for example, furnaces for all kinds of the lighter metallurgical processes are now designed to use coal gas and are giving every satisfaction.

Construction of a Spiral-Guided Gasholder*

By L. R. Cowley, of Shipley.

Having detailed the method by which a specification for a spiral-guided holder of 300,000 c.ft. capacity (to be erected in the tank of an old holder of similar capacity), to suit the particular conditions at Shipley, was drawn up by Mr. H. Burton, Engineer and Manager to the Shipley Gas Department, the author discussed special points in this specification.

In the first place an ordinary wrought-iron ladder was specified. The carriages are of the "Vulcan" type, two wheels gearing into each other to ensure positive movement of both carriages. The axles are of the floating type 3 in. in diameter with provision at one end for ball-thrust bearings to take up wind pressures and prevent the rubbing of the wheel boss against the carriage boss, thus setting up undue friction which might cause the wheels to be held up, causing the spiral rails to slide. The axles are automatically lubricated when working and the end caps give easy access for cleaning out old oil or for examination purposes (see fig. 1). Numerous charts have been taken on the holder proving conclusively that there is no tendency to stick whatever.

The tension members of the truss are constructed to flats, thus eliminating the more common turn-buckle. This appeared at first sight as if it would tend to cause difficulties in erecting, by cutting down any allowance for putting the bars in tension. Such, however, was not the case. By accurate measurements and construction all individual tension bars came into tension at the same point. I think the ease and safety with which this type of member can be attached to either truss plate or any other member counterbalances any doubt one may have in departing from strictly standard practice—so long, of course, as the member is of sufficient section to resist any stress to which it is subjected.

When the crown trussing was lowered to its position it was noticed that when any member of this truss was struck a blow, not very heavy, as could be almost expected, the whole truss, or a large part of it, commenced to vibrate. The direction of oscillation appeared to be lateral. Did this indicate that in the event of a gust of wind striking the holder this impact would be communicated, via the vertical stays and curb, to the trussing?

If it did, would the oscillation set up tend to decrease the resistance of the top curb to buckling?

Theoretically one could see no reason why it should cause any weakness, because all oscillation of this description (small, of course) would tend to be parallel to the circumference, and would, in the nature of an oscillation, neutralize itself in effect. It was thought, however, better to be on the safe side, and make sure that either no oscillation could take place, or that if any did it should become so communicated to all sections of the truss that it must become ineffective. In the original specification, no provision was made to connect individual trusses together, except in so far as they were connected at the curb and truss plates. It was therefore decided to cross-brace all trusses to each other. This we consider appreciably increased the resistance of the top curb to buckling, and in so doing, assisted also in reducing the resultant compressive stress.

Riveted or Welded Joints?

The question of electrically welded joints in place of rivetted was given consideration. I believe several all-

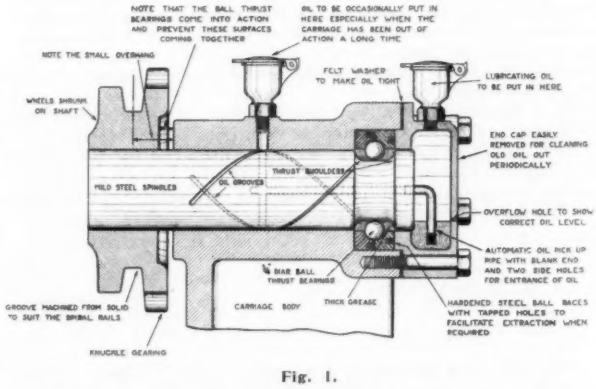

NOTE THAT THE BALL THRUST BEARINGS COME INTO ACTION AND PREVENT THESE SURFACES COMING TOGETHER
OIL TO BE OCCASIONALLY PUT IN HERE ESPECIALLY WHEN THE CARRIAGE HAS BEEN OUT OF ACTION A LONG TIME
NOTE THE SMALL OVERHANG
FELT WASHER TO MAKE OIL TIGHT
LUBRICATING OIL TO BE PUT IN HERE
WHEELS SHRUNK ON SHAFT
END CAP EASILY REMOVED FOR CLEANING OLD OIL OUT PERIODICALLY
MILD STEEL SPINDLES
OIL GROOVES
THRUST SHOULDER
OVERFLOW HOLE TO SHOW CORRECT OIL LEVEL
AUTOMATIC OIL PICK UP PIPE WITH BLANK END AND TWO SIDE HOLES FOR ENTRANCE OF OIL
¼ BAR BALL THRUST BEARINGS
GROOVE MACHINED FROM SOLID TO SUIT THE SPIRAL RAILS
CARRIAGE BODY
THICK GREASE
HARDENED STEEL BALL RACES WITH TAPPED HOLES TO FACILITATE EXTRACTION WHEN REQUIRED
KNUCKLE GEARING

Fig. 1.

welded holders have been constructed, but I am under the impression that distortion of shape during erection and use has not added to their popularity. The question of welding sheets of about ⅜ in. thickness also appears to need particular care. Although information of the corrosive effect of various substances on welded material is available, I am not aware of any tests extending over a period commensurate with that of the expected life of a gasholder.

The effect on the joint, too, of the electrolytic action likely to be set up between the metal of the sheet and that of the electrode also intrigued us, especially when it is ex-

* From a paper before the Yorkshire Junior Gas Association, Feb. 17, 1934.

tended over so long a period, and with such intimate contact. The effect of heat on the micro-structure of the metal, a very small distance away from the joint, also appeared to indicate a tendency to weakening of the sheets themselves at that point. This, I think, would be more pronounced on the thin sections used on gasholder construction than it would be in the case of structures where heavier sections are employed.

The Tender Accepted.

The tender finally accepted was that submitted by Messrs. Firth Blakeley, Sons, & Co., Ltd., who proceeded to construct the sections of the structure at their works at Church Fenton. Immediately the material was received at the contractor's works we received a notification from them to that effect, and I accompanied Mr. Burton to Church Fenton armed with rules, micrometers, sheet gauges, &c., with the intention of examining everything " examinable " before fabrication. We were immediately struck on arrival by the " nothing to hide " attitude of the contractors: " There's your holder—in bits—and there is our works; examine everything " was their attitude. And we very nearly did.

Sheets for all sections were examined minutely and measured. All rolled steel sections were measured and compared with standard section measurements. Bolts and rivets were tested; maker's tests of plates, bars, &c., were examined. Forty-six sheets of various sizes were measured in each direction, approximately 150 readings being taken, all of which were well above specified sizes. The average of all these gave a figure of 5·3% above specification. We were satisfied; and the makers then commenced to erect the crown and top row sheets cold. On the completion of this we again visited Church Fenton, and returned once more satisfied that the contractors intended to make a good job for us.

The old rest blocks, 30 in number, consisted of stone slabs 18 in. by 12 in. by 9 in. to 10 in. thickness built into the tank bottom. The levels of the tank coping were taken and the relative position of the 20 new rest blocks were marked on this coping. From these points a plumb-line was dropped to tank bottom and the top surfaces of the new rest blocks were determined. The positioning of these blocks, to give equal chords, required considerable manœuvring. This was due to the tank not being perfectly round. It was found that the positions of the new rest blocks, in only two cases, coincided with the old ones, and it was decided to remove them completely as new blocks

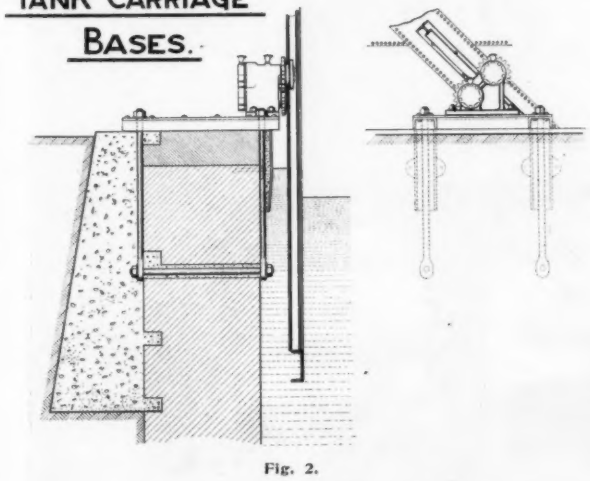


Fig. 2.

would be higher than the old ones. When a commencement was made to do this, however, it was found that the old blocks were bedded on the original puddle clay, and in attempting to remove one, a leak developed at that place. Complete removal was therefore abandoned and the stone blocks where they coincided or nearly so with the positions of the new blocks were cut off at floor level only, the new blocks to be formed on this good foundation. This, no doubt, saved considerable water trouble.

Several methods of fixing the holding-down bolts had been suggested, but finally it was decided to put two of each set inside the tank, these to be tied by anchor bolts to the other two let into concrete, and the two in the tank to be surrounded by cast-iron shields which were concreted around the bolts to above the water level. It was ultimately decided that the better method of procedure was to take down as much of the tank sides as necessary, excavating outside the tank, and then to re-build up the tank with anchor bolts embedded in concrete, and bring up the concrete level around the two outside bolts to coping stone level (see fig. 2).

Inlet and Outlet Pipes.

The inlet and outlet pipes in the old holder had been tied together by means of clamps, and it had been thought desirable that the pipes should be separated. It was decided to remove the inlet pipe a distance of about 50 ft. from the outlet. A special casting was made to be jointed to the inlet pipe at the tank bottom level, and the inlet main was carried on the tank bottom to its new position (see fig. 3).

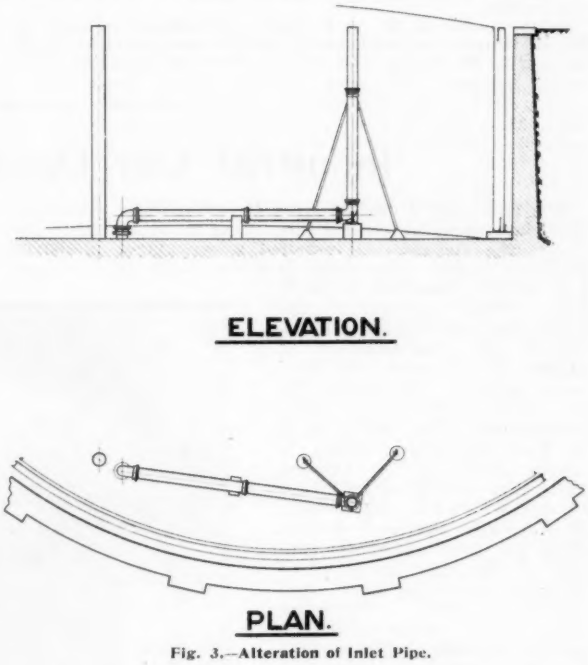


Fig. 3.—Alteration of Inlet Pipe.

Ample supports for this horizontal main were constructed of concrete and separate supports for the vertical sections communicated any possibility of movement to a foundation at the tank floor level.

Advantage was also taken to re-caulk all joints on these mains, clean outsides, and paint with red lead all supports. The support for the outlet pipe consisted of a lattice girder which was bolted into one of the supports for the horizontal part of the inlet main by means of a flat steel bar with screwed ends (of 5 ft. length), being embedded in this concrete pillar.

Discussion.

The President (Mr. B. Thorpe, of Huddersfield) said that Mr. Burton, Mr. Cowley, and all concerned in this work were to be complimented on the courageous manner in which they had tackled a rather big job.

Mr. A. W. Elliott (Elland) congratulated Shipley on its venture, but inquired why the winter time had been chosen for a job occupying six or seven months—the time when, presumably, the storage demand was at its greatest. Mr. Elliott said it would be generally interesting, from the point of view of life of the holder, to know whether iron or steel was used in the construction of the side plates, cups and lips, crown sheets, &c. Could Mr. Cowley give any special reason for the material chosen?

Mr. Cowley, replying, said the side plates were of steel. The conditions at Shipley demanded that the question of cost be taken into consideration. Mr. Cowley said he was afraid he could not give an authoritative reason for the work being done during the winter, but in actual practice it was probably the most convenient time, because they were dismantling two old holders and they had to erect two new ones within a specified time.

Mr. Elliott said he had had some experience of a comparatively new holder, one about four years old, in which the side and crown plates were of iron and the cups and lips of steel, and it was found that corrosion was definitely more marked in the steel than in the iron.

Mr. Cowley, in answer to a question by Mr. J. Roberts (Bingley), detailed the methods employed by the Department in checking and testing the rivets during the new work, and said that was a matter which was very carefully watched, as obviously it must be. In further answer to Mr. Roberts, he said flooding holes were arranged in the cups. This was a matter on which they made a particular point because they had had flooding trouble with another holder of similar character.

The President agreed with the contention that the spiral type of holder necessarily afforded an economy in painting and

maintenance costs, due to the absence of columns and supporting girders, &c. Mr. Thorpe quoted an instance of a column-guided holder in regard to which he would be inclined to compare favourably the cost of painting and maintenance against that of a spiral-guided holder, without impairing the efficiency and safety of the holder.

Mr. COWLEY said that in regard to painting and maintenance costs he still felt there was a definite advantage in the spiral-guided holder.

VOTES OF THANKS.

Mr. A. W. ELLIOTT (Elland) proposed a vote of thanks to Mr. Cowley for his paper and to Mr. Burton, the Engineer, for allowing the information to be given in such detail.

Mr. J. N. DOUGHTY (Sheffield) seconded the motion, which was carried.

On the motion of Mr. V. F. SIDDONS (Sheffield), seconded by Mr. H. HODGSON (Leeds), hearty thanks were expressed by the meeting to Mr. Burton and the Chairman and members of the Shipley Gas Committee for the facilities offered for the meeting.

Mr. BURTON, responding, said he wished personally to compliment Mr. Cowley on the manner in which he had prepared his paper. On the question of the relative values of iron or steel for holder work, at Shipley they were working under a heavy burden of old debt charges arising from the purchase of the undertaking years ago. He was glad to say this handicap would fall out in 1942, but in the meantime everything they did had to be done under very serious consideration on the question of cost as well as working life. In pulling down the old holder, continued the speaker, they found evidence of old puddled iron, some of it with the bloom still on it. One would be fairly safe in feeling that if one could get hold of some of the good old puddled iron—say, of the old Low Moor character—one could expect a working life of 60 years comfortably, whereas mild steel might be only a matter of 30 years or so. Of course, there was also the problem to consider as to whether, in view of progress and changes, one actually desired to have a holder intended for 60 years.

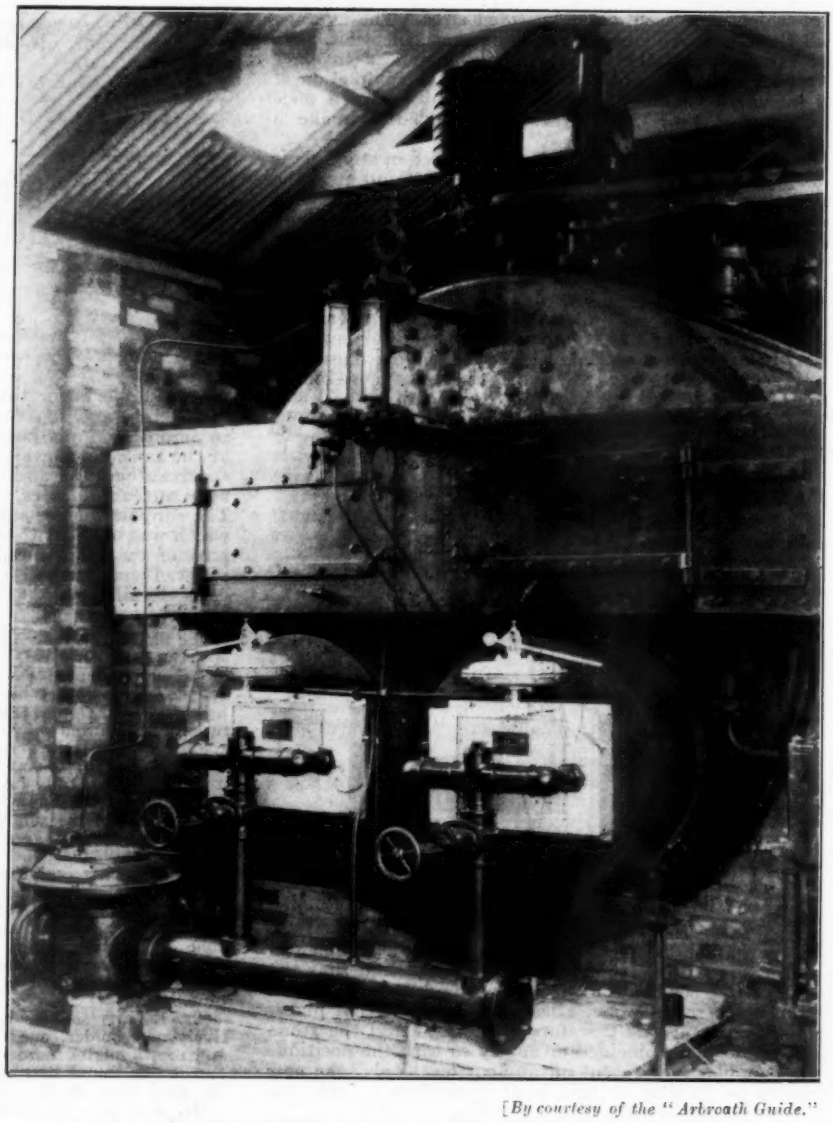
Industrial Gas Development at Arbroath

The Arbroath Municipal Gas Department is attracting much attention by several interesting developments. Recently the Department installed a very large industrial gas-fired boiler. The boiler is a dry back marine type, 8 ft. 6 in. in diameter by 10 ft. long. The equipment and apparatus provides for a maximum gas consumption of 14,000 c.ft. per hour, and have been specially constructed by British Furnaces, Ltd., Chesterfield. The boiler is to be used for raising steam to supply heat to an existing hot water system of extensive commercial hot-houses. Mechanically operated devices allow the joint automatic control of the gas burners, air draught, steam pressure, and water supply, each being operated by regulators related one to the other. The system has been installed under the supervision of Mr. D. Morton, Gas Engineer, in co-operation with British Furnaces, Ltd.

The gas is led to the boiler house through a 6-in. service pipe, and is taken through a high-capacity meter through a 5-in. pipe to the boiler. A "thermogas" control automatically regulates the gas supply to the specially constructed burners. A by-pass arrangement is led off to two regulators which operate louvres controlling the air to the burners. The adjustable and movable louvres allow the correct proportion of air to be entrained from the atmosphere. Whenever the desired steam pressure is reached in the boiler the gas supply is automatically cut out and the small regulators controlling the air louvres go into the new position, shutting the air intakes and preventing cold draught causing a decrease in the boiler temperature. A regulator can be set to whatever is the required steam pressure, and a by-pass pipe for gas under pressure connects it to the other controls, so that when steam pressure and gas pressure in the by-pass, through the position of the control, are equalized, the gas supply is cut out and the other automatic control devices also come into operation. The by-pass pipe from the regulator is led into the boiler, and there a small quantity of gas is burned for safety.

Steam is led from the boiler and injected to the hot water system glass-houses through an injector and reducing valves which provide an endless circulation throughout the hot-houses, where there is approximately 4,000 sq. ft. of glass. The system can also supply high-pressure steam, which is to be used for sterilizing the ground.

On tests recently made, the boiler was steamed at 85 lbs. per sq. in., the valves then being ¼ open. The regulators have now been set to steam at 18 lbs. per sq. in. Under the latter setting it has been possible to raise the temperature in these houses from 55° F. to 81° F. in approximately one and a quarter hours, with a gas consumption of about 2,300 c.ft. per hour.



[By courtesy of the "Arbroath Guide."

LARGE INDUSTRIAL GAS-FIRED BOILER AT ARBROATH.

The Recovery of Benzole from Vertical Retort Gas*

EXPERIENCE AT SWINDON

By C. H. Chester, F.C.S., General Manager and Secretary, Swindon United Gas Company.

During recent years, benzole recovery has once more become a subject of considerable interest to gas companies in this country. As pertaining to horizontal retort practice, the position appears to have been fairly thoroughly established, and with the possible exception of very small works, and those with a prohibitive calorific value standard, benzole recovery is being extensively and enthusiastically adopted.

The treatment of gas from vertical retorts, however, might not appear at first sight to be particularly attractive unless under exceptionally favourable conditions, and it is for this reason, perhaps, that benzole recovery from such gas is not being pushed forward quite so vigorously.

Numerous companies having vertical installations are now recovering benzole profitably, but at the same time many others are still weighing the pros and cons. It is with the aim of supplementing the meagre information available and showing the attractive possibilities and actual results of such recovery, that this account of the performance of the benzole plant at the Swindon United Gas Company's Works is being presented.

At this works the carbonizing plant consists of three beds of Glover-West vertical retorts, having eight retorts to each bed.

During the year previous to the installation of the benzole plant, the average daily make of gas was: Winter, 831,000 c.ft., summer 814,000 c.ft., exclusive of external water gas. Two beds of retorts only were in use, fluctuations and irregularities of demand being accommodated by varying the amount of steaming, masking-off retorts, &c. Assuming an average yield per retort of 2,500 c.ft. per hour, it will be seen that the full quota of retorts was seldom in operation and the incidence of maintenance and overhead charges therefore high.

One of my first duties on coming to the Company was to boost up the sale of gas against keen electrical competition.

An "Ideal Bulk Consumer."

Although the campaign waged to effect immediate and extensive increase in gas sales would, I believe, prove interesting and instructive, such digression is impossible within the limits of the present paper, and I will therefore confine my remarks to the part played by the benzole plant in its rôle of "the ideal bulk consumer."

Since the extraction of benzole implies the provision of a higher calorific value at the retort, and therefore a corresponding decrease of internal steaming, by assuming an average yield of 17,000 c.ft. per ton of slightly richer gas, with an increase in calorific value of the order of some 8 B.Th.U. per gallon extracted per ton, the quantities involved may be estimated.

Considering an extraction of 1½ gallons per ton and using the values given by Hoffert and Claxton,† a transposition of the formula given by them shows a required value of 462 B.Th.U. per c.ft. with an extra quantity of gas to be made equal to 2·94%. It would perhaps give a clearer conception if this be considered not as equivalent make of gas, but as corresponding extra throughput of coal, since the gas, as such, is not actually made, whereas the extra coal is plainly in evidence.

Investigation showed an extractable hydrocarbon content of 3·4 gallons per ton by an oil-washing test. The recovered spirit on distillation yielded 91·5% at 160° C. from a standard side-arm flask, thus showing an available yield of slightly over 3 gallons of crude benzole per ton, at the declared value of 450 B.Th.U. With decreased steaming, of course, a slight increase on this figure was to be expected. The outstanding economic and technical considerations were thoroughly probed and appeared to be quite satisfactory. In fact, no particular objection or "snag" could be discovered of any practical weight.

The plant finally decided upon, and installed about twelve months ago, was guaranteed to extract 1½ gallons of good quality crude benzole per ton of coal carbonized. It was, of course, understood—and guaranteed—that a very definite profit would be obtained from the benzole plant per se, apart from incidental advantages. This naturally is the crucial point, and a glance at the balance-sheet will show to what extent assumptions have been justified.

The quality of the spirit decided upon was 75% at 120° from a standard flask. It might be mentioned here that a high test spirit may not in all cases be advantageous, and each company ought to find its own optimum under working conditions. For example, where there is no outlet for the heavy fraction, it may be profitable to lower the quality of the benzole and so increase the yield. This refers, of course, to the existing specification for crude benzole.

In our own case we are at present extracting about 2·2 gallons per ton of 76% to 77% test, although we could get considerably higher test with an extraction of only 1·5 gallons. The quality of benzole obtainable is, of course, simply a matter of setting the thermostatic control at the required temperature.

Some idea of the quantities involved can be obtained from the following monthly figures taken as being fairly typical and having the advantage of including a period during which special tests were made and special observations taken

January, 1932. Metered gas. 26,279,000 c.ft. at 450 B.Th.U.

= 118,255·5 therms.
No external water gas.

January, 1934. Metered gas. 29,090,000 c.ft. at 450 B.Th.U.

= 130,905 therms.
No external water gas.
Benzole produced, 3,755 gallons = 5,633 therms.
Heavy distillate from gas, 154 gallons.

January, 1933, was about the same as the previous year, but, having the complication of admixed carburetted water gas, has been omitted in the comparison.

Taking the thermal value of 1·5 therms per gallon, the total hydrocarbons removed from the gas account for 3,909 × 1·5 = 5,863·5 therms. The benzole alone, 3,755 gallons, represents 5,633 therms. Taken on the basis of 1932, this is equivalent to an increase of 4·76%, and on the past month's working of 4·3%. The potential therms in the heavy distillate are of relatively low value, although they may not always remain so. At Swindon the heavy distillate is returned to the water-gas plant and credited at the price of gas oil, to which it is roughly equivalent.

The apportioning of the heavy fraction between the gas and the wash-oil is done as follows: 10% of the benzole make is taken as the amount distilled out of the gas oil, and the remainder as being naphthas extracted from the gas.

Example:

	Daily Makes.	
Benzole	130 galls.	
Heavy distillate . .	25 ,,	(ex. gas 12 galls. Ex. gas oil 13 galls.)

In passing it may be observed with what success the outside competition is being met, the thermal increase showing 12,650 therms or 2,811,000 c.ft. in this particular month, a percentage increase in gas sales of 10·7. That, as already stated, is a story in itself.

Extra Coke Produced.

On the credit side of the account, there is another factor of considerable importance—namely, the extra coke produced. At Swindon the coke market is exceptionally good, and any extra quantity, besides being a revenue producer,

* Paper before the Western Junior Gas Association, Feb. 24, 1934.

† "Motor Benzole," Hoffert and Claxton.

creates a certain amount of goodwill. Now, to produce the extra therms to satisfy the benzole plant regarded as a bulk consumer, considerably more coal will be required during any particular period, so increasing the available coke. Taking actual working results, I find that the average increase for the past 10 months has been 33·85 tons per month.

This implies more retorts in operation for the same standing charges. Indeed, the extra retorts necessitated by the total increase in throughput are being attended to by the same number of operators without difficulty.

Apart from the welcome effect on the balance-sheet, the most noteworthy feature of the plant is its very convenient flexibility. In the same way as it could if necessary be used to smooth out fluctuations in the load curve, it can be used in times of emergency or sudden demand in a way that is extremely gratifying. We have been obliged at times to close down the plant for short periods during peak demands due to sudden fog, cold snaps, &c. In the same way it is a useful safeguard against the various minor accidents met with occasionally, as, for example, a bad patch of coal. The thermal reserve is usually sufficient to cover the bad period. In this respect the plant has a useful feature, which may or may not be present on all benzole plants, in that it can be completely shut down in a few minutes and restarted in about the same time without necessarily skilled attention. In the same way it may be mentioned that it is so arranged that daily operation is reduced to the very minimum. Arising from this, there is a further point to be noted—should the demand be for immediate extra therms, the scrubber is by-passed; on the other hand, during any form of breakdown or similar interruption, the stripping is continued and the benzole excess distilled off later.

The Naphthalene Question.

Naphthalene troubles are not usually associated with vertical retort installations, but it is a moot point whether in some cases a slight excess over saturation may not be slowly depositing and laying the foundation for future trouble. During the past month the highest quantity found at Swindon was 2·83 grains per 100 c.ft. at the inlet to the benzole scrubber, no trace having been found in the outlet gas. The naphthalene is removed in the scrubber and passes away in the heavy distillate fraction, so that in any case that particular possibility concerns us no more.

Following on these preliminary remarks, the actual balance-sheet can now be considered.

Benzole Plant—Year ended Dec. 31, 1933.

Benzole made during the year—
30,084 galls. : 44,509·5 therms : 9,891,000 c.ft.

Particulars.

	£ s. d.	£ s. d.
By receipts from benzole sold	1,309 2 4	
Cost of extra coal—		
702½ tons at 27s. 11d. per ton		980 6 9
Cost of gas oil—		
4,778 galls. at 4½d. per gall.		84 12 3
Revenue from additional coke—		
338½ tons at 25s. 3½d. per ton av.	428 1 3	
Revenue from additional tar—		
10,155 galls. at 3d. per gall.	126 18 9	
Gross profit		799 3 4
	£1,864 2 4	£1,864 2 4
Gross profit brought down	£ s. d. 799 3 4	£ s. d.
Extra costs and charges (Capital expenditure, £600)—		
Interest, 5% / Depreciation, 5% } 12½%		75 0 0
Repairs, 2½%		
Working costs		84 0 0
Net profit		640 3 4
	£799 3 4	799 3 4

The working costs may be considered in greater detail if the profit is calculated on the basis of one gallon of benzole, as follows:

Working Costs.

	d.
Steam—33·4 lbs. at 1s. per 1,000 lbs.	0·401
Water—68 galls. at 3d. per 1,000 galls.	0·204
Labour	0·110
Capital charges—	
Depreciation, interest, and repairs	0·598
Replacement—1½ therms at 2·68d. per therm	4·020
	5·333
Revenue from benzole	10·44d. per gall.
Profit from 30,084 galls.	£640 3s. 4d.

The low cost of water as shown above is due to the charge being for pumping only, since the water is simply circulated.

Description of Plant and its Operation.

The compactness of the benzole recovery plant is clearly shown in the accompanying photograph (plate I.). It is, in fact, an important feature of the design that so little ground space is required that practically no site is too constricted or inconvenient for its erection. The elongated design also ensures that the strength of the vessels under pressure leaves a wide margin of safety.

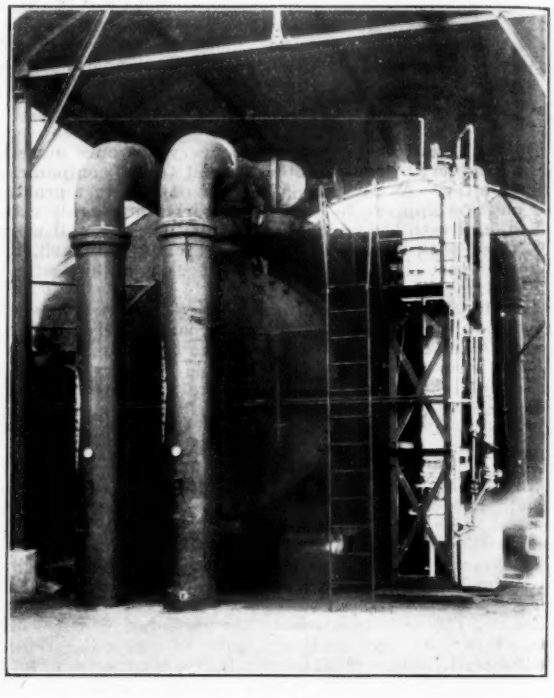


Plate I.

Under prevailing conditions it was not possible to obtain a satisfactory photograph of the front elevation, and therefore a plate has been included (plate II.) of a plant of similar design where detail may be more plainly observed.

The oil pump suction is taken from the gas inlet bay of the washer, which is a five-bay washer of the well-known W. C. Holmes & Co.'s rotary brush type fitted with the usual by-pass connections. The small Douglas rotary pump driven from the engine shaft passes the oil from the gas inlet bay of the washer to the base of the tubular preheater. The pump has a by-pass line fitted with a needle-valve control, slight adjustment of which allows of fine regulation of the amount of oil in circulation. A differential gauge working across a calibrated orifice plate shows the rate of flow.

From the top of the steam-jacketed preheater, the oil travels along a short connecting pipe to the top of the still, being then sprayed over a distributing plate on to the patent packing of Lessing rings. The still is steam-jacketed, so that there is no danger of condensation of the live steam injected at the base to effect steam distillation of the benzolized oil. The efficiency of this form of packing is, I think, too well known to need special emphasis here. A Negretti & Zambra high-pressure mercury thermometer is fitted to indicate the temperature of the oil leaving the preheater, the element being fitted in the connecting pipe between preheater and still. The dial can be seen on plate II. fitted on the instrument board for convenient observation. The stripped oil leaving the base of the still passes through a cooler and is returned to the gas outlet end of the washer, while the vapours, passing from the top via the anti-splash chamber, are brought to the base of a fractionating column (see plate II.) also packed with Lessing rings. Here the vapours receive a preliminary fractionation, the final adjustment of quality being made by means of a dephlegmator (or fractionating condenser) of a tubular, quick-acting type. This is controlled by a thermostat, the setting of which can be adjusted to give any practical quality or range required. The temperature used in this case is 83° C.

The supply of live steam to the still is controlled by a valve and an orifice plate, the reading on the pressure gauge fitted between the valve and the plate indicating the amount of steam passing; in this case about 10 lbs. per gallon of distillate. The condensate from the dephlegmator

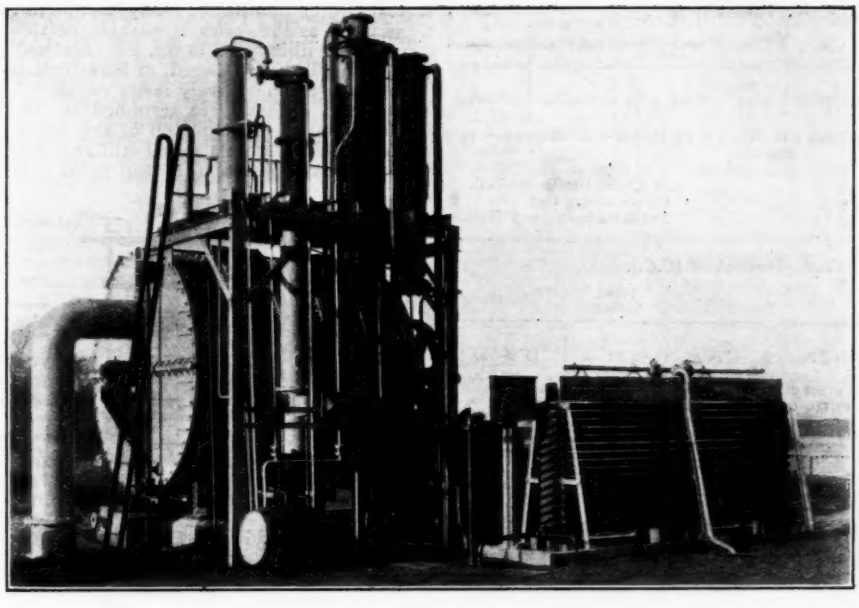


Plate II.

irrigates the packing in the column below and flows through a seal to a separator. This fraction consists of the heavier hydrocarbons including the naphthalene, together with a proportion of the water condensed from the steam.

The benzole vapours pass from the still to a condenser, then through a seal to the separator, and finally to the storage tank. Sight boxes are provided to allow of a visual check on correct working.

The steam pressure to the plant is set at 70 lbs. per sq. in. maximum. This pressure is probably more than is actually necessary, but it allows an extra margin of safety. At present we have no reducing valve attached to the plant, but on the whole I am of the opinion that such expense would be justified.

The temperature of the oil leaving the preheater is about 115° C. This temperature is arrived at by a consideration of both the distillation of the oil returning to washer, and the naphthalene test on the outlet gas. Obviously one does not wish to overstrip the oil and so hasten the eventual thickening, while at the same fime naphthalene must be kept out of the outlet gas. In our own case we have not found any naphthalene in either the stripped oil or the outlet gas.

Very little attention is required to operate the plant. For purposes of record the foreman logs the two temperatures (preheater and dephlegmator) and the open steam pressure on his rounds, and a quantity of oil, about 5 gallons, is now run out daily for purposes of replacement. This replacement, together with the loss of gas oil of, say, 0·1 gallon per gallon of benzole amounts to about 17 gallons per day and is made up from stock. This replacement is intended to prevent formation of sludge, but should the water gas plant not be able to use up this extra amount at any time, we should not hesitate to revert to our previous practice of using no replacement oil.

In January of this year, after almost twelve months' working, all the oil was deliberately run out of the washer to ascertain the extent of sludge formation. From a practical point of view, the oil was quite fluid and substantially free from sludge. The only definite sludge found was a medium quantity in the oil cooler—about a bucketful.

Gas oil is used as the scrubbing medium and appears to be in every way highly suitable. The rate of circulation is 90 gallons per hour, equal to about 40 gallons per ton.

The temperature of the return oil is kept at about 19° C., and it is of interest to note the progressive temperatures across the washer. The first example below is from normal working, while the other shows the effect of a higher return oil temperature. As may be judged, we seldom find that any moisture has been condensed from the gas in the washer.

Oil to Washer.	Bays.					Inlet Gas.	Outlet Gas.
	1	2	3	4	5		
°C.	°C	°C.	°C.	°C.	°C.	°C.	°C.
19	14	13	12·5	12	11·5	9	12
23	15	14	13	12	11·5	9	12

On the instrument board there are three instruments, a steam gauge showing the amount of live steam used, and two Negretti thermometers showing respectively the temperatures of the preheater and the benzole vapours.

Choice of Coals.

In order to test the suitability of other coals which have been under consideration at various times, an investigation was carried out using coals from different districts, and possessing different properties, including the important one of cost. The results of the laboratory and full scale tests are set out below, and it will be seen that over what is for my purpose a fairly wide range, there is a sufficient amount of available benzole to keep the stripping operation on the same attractive level. Each full-scale test was carried out over two consecutive days, and the benzole plant was left working in the usual way as a sufficient indication of any change in benzole content of the gas.

Coal: Forest of Dean (E.U.).

—	V.M.	Ash.	Fixed Carbon.	Sulphur.	(Moisture).
Prox. analysis—(Dry basis) . .	32·0%	9·98%	58·02%	0·94%	(1·51%)
Make per ton . .	16,140 c.ft. at 451 B.Th.U. per c.ft. stripped = 72·79 therms.				
Benzole make .	2·21	gals. per ton = 3·32 therms.			
Benzole content by laboratory test	3·53	,,	,,	St. Claire Deville method.	
	3·36	,,	,,	Oil scrubbing test.	
Mean = .	3·45	,,	,,	Available (90%) = 3·1 galls.	

Coal: Forest of Dean (P.R.).

—	V.M.	Ash.	Fixed Carbon.	Sulphur.	(Moisture).
Prox. analysis—(Dry basis) . .	32·0%	8·30%	59·70%	2·14%	(1·84%)
Make per ton . .	15,800 c.ft. at 450 B.Th.U. per c.ft. stripped = 71·1 therms.				
Benzole make . .	2·12	gals. per ton = 3·18 therms.			
Benzole content by laboratory test	3·44	,,	,,	St. Claire Deville method.	
	3·20	,,	,,	Oil scrubbing test.	
Mean = .	3·32	,,	,,	Available (90%) = 2·99 galls.	

Coal: South Yorkshire (T.P.).

—	V.M.	Ash.	Fixed Carbon.	Sulphur.	(Moisture).
Prox. analysis—(Dry basis) . .	32·3%	2·70%	65·00%	1·37%	(1·70%)
Make per ton . .	17,993 c.ft. at 450 B.Th.U. per c.ft. stripped = 80·97 therms.				
Benzole make . .	2·48	gals. per ton = 3·72 therms.			
Benzole content by laboratory test	3·68	,,	,,	St. Claire Deville method.	
	3·89	,,	,,	Oil scrubbing test.	
Mean = .	3·78	,,	,,	Available (90%) = 3·4 galls.	

Coal: Yorkshire (F.).

—	V.M.	Ash.	Fixed Carbon.	Sulphur.	(Moisture).
Prox. analysis— (Dry basis) . .	31·75%	4·75%	61·10%	1·04%	(2·40%)

Make per ton . . 17,640 c.ft. at 449 B.Th.U. per c.ft. stripped = 79·2 therms.
Benzole make . . 2·19 galls. per ton = 3·29 therms.
Benzole content by laboratory test 3·75 ,, ,, St. Claire Deville method.
3·53 ,, ,, Oil scrubbing test.
Mean = . 3·64 ,, ,, Available (90%) = 3·28 galls.

Coal: Derbyshire (C.C.).

—	V.M.	Ash.	Fixed Carbon.	(Moisture).
Prox. analysis— (Dry basis) . .	31·67%	4·78%	63·55%	(5·90%)

Mixture . . . . Forest of Dean. Yorkshire. Derbyshire.
Make per ton . . 17,140 c.ft at 452 B.Th.U. per c.ft. stripped = 77·47 therms.
Benzole make . . 2·38 galls. per ton = 3·57 therms.
Benzole content by laboratory test 3·82 ,, ,, St. Claire Deville method.
— Available (90%) = 3·44 galls.

Coal: Mixture. South Yorkshire and North Derbyshire.

Make per ton . . 17,040 c.ft. at 452 B.Th.U. per c.ft. stripped = 77·11 therms.
Benzole make . . 2·14 galls. per ton = 3·21 therms.
Benzole content by laboratory test 3·55 ,, ,, St. Claire Deville method.
— Available 3·20 galls.

Other mixtures of Forest of Dean, Yorks., and Derbyshire, in varying proportions, gave:
On plant: Av., 2·2 galls. per ton.
By laboratory test—Av. available galls. per ton: 3·70, 3·50, 3·34, 3·44.

Analyses of further batches of coal used in these mixture tests are as follows:

—	V.M.	Ash.	F.C.	(Moisture).
	%	%	%	%
Yorks. (B.) . . .	34·50	5·00	60·50	(9·04)
Yorks. (M.M.). . .	35·36	4·87	59·77	(2·87)
Derbyshire (S.) . .	34·70	2·80	62·50	(6·48)

Brief mention might be made of the reduction in specific gravity of the gas and the removal of a proportion of the sulphur content, both of which effects are, in my opinion, of definite importance.

In summarizing, then, the reasons in favour of the partial stripping of benzole from vertical gas, an attempt has been made to show that:

(1) The process is a profitable one in itself.
(2) In relation to peak loads it can be used to some extent as a thermal accumulator.
(3) It creates an extra load for underworked plants.
(4) The whole plant, including the naphthalene scrubber, is practically automatic and requires the very minimum of attention.
(5) Various incidental benefits are obtained.
(6) There is a valuable form of propaganda involved.

During the course of the investigation into the suitability of different coals, the opportunity was taken of carrying out various laboratory tests. These tests are quite outside routine work as far as the smaller works are concerned, but they are given in the form of an appendix for the information of those interested.

The plant was erected by W. C. Holmes & Co., Ltd., Huddersfield, to whom I am indebted for valuable assistance in the preparation of this paper, and particularly to Mr. J. N. Hazeldon, M.Sc., M.I.Chem.E., of their technical staff, who has collaborated with me throughout.

APPENDIX I.

The benzole content of the gas was estimated by two methods differing entirely in principle. The oil scrubbing test will be familiar to many, although the apparatus is not as usual as the series of washing bottles. The metal tower scrubber illustrated in fig. 1 is identical in design with that used by T. F. E. Rhead, of Birmingham, and allows of the use of a comparatively large volume of gas. In the tests, 200 c.ft. of gas were scrubbed by 10-12 litres of oil fed continuously into the top of the tower. The rich oil was first distilled from a metal still and then fractionated in an eight pear column to a stop point of 160° C. This crude

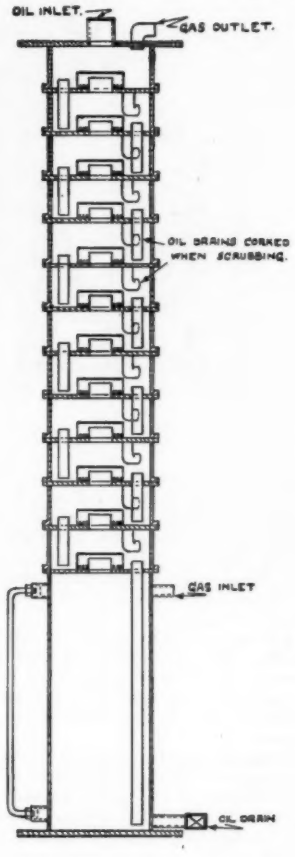


Fig. 1.

benzole was then distilled from a side-arm flask in the usual way.

The Sante-Claire-Deville test apparatus is shown in fig. 2, the method consisting in the freezing out of the available hydrocarbons at a low temperature. The thoroughly dried gas having passed through calcium chloride and phosphorous pentoxide, enters the test tubes immersed in a paste of solid CO_2, and acetone, where the hydrocarbons condense, and mostly freeze solid. The solid CO_2 was obtained in the classical way by discharging highly compressed CO_2 into a porous bag.

The results obtained by the two methods agreed fairly

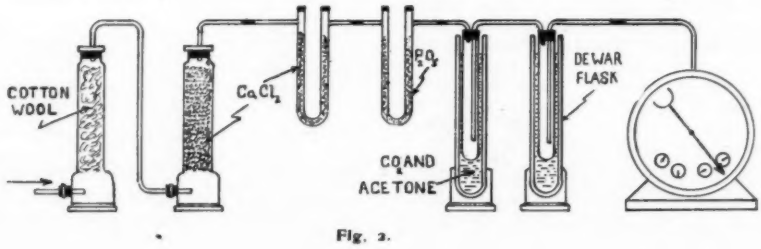


Fig. 2.

closely—to within about 0·2 gallon per ton. The low-temperature method appears to give the higher result, but the number of tests carried out was not sufficient to enable a definite statement to be made. In this method, the small quantity of benzole obtained does not permit of a distillation, although the specific gravity can be estimated.

This quick and convenient method was used to estimate the difference in benzole content across the washer. In this way results were obtained which agreed very closely with the observations taken from the benzole plant records.

Gas.

The effect on the unsaturated hydrocarbon content of the gas was checked by a series of determinations in the Orsat apparatus. The mean of a number of determinations gave: Inlet washer, 2·3%; outlet washer, 1·8%. This is in accordance with what would be expected on theoretical grounds.

The difference in calorific value before and after stripping as shown by a Sigma calorimeter and the standard Boys respectively averages 18 to 20 B.Th.U. per c.ft.

Benzole.

Typical distillations are given below of benzole recovered from Yorkshire and Forest of Dean coals, the distillations being made from a standard flask.

—	Yorks.	Forest of Dean.
Sp. gr.	0·829	0·830
Drop point	..	..
70° C.	0·5%	0·5%
80 ,,	3·5 ,,	2·5 ,,
90 ,,	23·0 ,,	23·5 ,,
100 ,,	54·5 ,,	53·5 ,,
110 ,,	68·0 ,,	67·0 ,,
120 ,,	77·5 ,,	77·5 ,,
130 ,,	82·5 ,,	85·5 ,,
140 ,,	87·5 ,,	91·5 ,,
150 ,,	92·0 ,,	95·5 ,,
160 ,,	95·0 ,,	97·5 ,,

The corresponding heavy distillates were:

Heavy Distillate.

—	Yorks.	Forest of Dean.
Sp. gr.	0·852	0·840
Drop point	121° C.	127° C.
130° C.	0·5%	..
140 ,,	2·0 ,,	2·0%
150 ,,	3·5 ,,	5·0 ,,
160 ,,	5·5 ,,	10·0 ,,
180 ,,	10·0 ,,	32·0 ,,
200 ,,	15·5 ,,	50·0 ,,
220 ,,	24·0 ,,	61·5 ,,

From inspection it can be seen that there is no appreciable quantity of saleable benzole being carried away in this fraction.

As a matter of interest a sample of heavy distillate was tested for quality, since in some cases—*e.g.*, benzolized oil distillation—the quantity distilling below 160° C. is referred to as crude benzole.

The results are shown below:

Heavy Distillate.

Sp. gr.	0·846	..	
Distillation	140° C.	..	3·0%
	150 ,,	..	5·5 ,,
	160 ,,	..	9·5 ,,
	180 ,,	..	22·0 ,,
	200 ,,	..	35·0 ,,

Distilled through an eight pear column, this sample yielded 15·0% distillate at 160° C., sp. gr. 0·822.

The standard distillation of this distillate gave the following result:

Distillation	100° C.	..	0·25%
	110 ,,	..	1·50 ,,
	120 ,,	..	14·50 ,,
	130 ,,	..	32·00 ,,
	140 ,,	..	50·00 ,,
	150 ,,	..	70·00 ,,
	160 ,,	..	83·00 ,,

The yield of heavy distillate on the day in question was 0·36 gallon ptr ton. The distillate to 160° C. therefore is: 0·15 × 0·83 × 0·36 = 0·045 gallon per ton, which is about 2% on the benzole made. The quantity at 120° C. in the same way equals 0·008 gallon per ton, or less than 0·5%.

As already mentioned, the lower boiling compounds in this fraction can be entirely eliminated if required, by increasing the temperature of the vapours leaving the dephlegmator.

Stripped Oil.

The return oil distillations corresponding to the typical distillations given previously are:

—	Yorks.	Forest of Dean.
Sp. gr.	0·871	0·870
Drop point.	208° C.	..
230° C.	0·5%	0·5%
240 ,,	1·5 ,,	1·5 ,,
260 ,,	4·0 ,,	4·0 ,,
280 ,,	12·5 ,,	7·5 ,,
300 ,,	39·0 ,,	23·0 ,,

APPENDIX II.

Comparison of standard side-arm flask with standard eight pear column distillations:

—	Flask.	Column.
Sp. gr.	0·830	0·830
100° C.	53·5%	53·0%
120 ,,	77·5 ,,	73·5 ,,
160 ,,	97·5 ,,	95·5 ,,
Sp. gr. (0°–160° C.)	0·831	0·8335

—	Flask.	Column.	—
Sp. gr.	0·829	0·829	
100° C.	54·5%	54·5%	Sulphur (orig.) 0·91 %
120 ,,	77·5 ,,	73·0 ,,	,, (0°–160° clm.) 0·888 ,,
160 ,,	95·0 ,,	93·5 ,,	Unsaturateds 6·5 ,,
Sp. gr. (0°–160° C.)	..	0·831	(Colman and Yeoman) Sp. gr. after removing unsats. 0·835

—	Flask.	Column.	Flask.	Column.	Flask.	Column.
Sp. gr.	0·833	0·833	0·8245	0·8245	0·822	0·822
100° C.	55·5%	55·5%	51·0%	52·0%	60·5%	59·5%
120 ,,	76·5 ,,	72·5 ,,	76·0 ,,	72·5 ,,	83·5 ,,	79·0 ,,
160 ,,	95·0 ,,	92·5 ,,	96·0 ,,	93·5 ,,	97·0 ,,	95·5 ,,
Sp. gr. (0°–160° C.)	0·834	0·834	..	0·827	..	0·8235

Sulphur.—With benzole at 0·830 sp. gr., a sulphur content of 1% by weight would be equal to 843 grains per gallon. Assuming a gas yield of 17,000 c.ft. per ton, the sulphur removed from the gas by the benzole alone would amount to 1·1 grains per 100 c.ft. for each 0·1% of sulphur in the benzole, at the average recovery of 2·2 gallons per ton.

Discussion.

Mr. S. Hole (President), before calling upon Mr. Marsden, Chief Chemist of the Bristol Gas Company, to open the discussion, said he felt the paper was one which would make a useful reference on a subject which was receiving much attention. The methods of testing given in the appendix would be appreciated by smaller works.

Mr. A. Marsden (Bristol) said his experience with benzole recovery was chiefly associated with pre-war and war-time plant. He could not give personal experiences of the modern Holmes regeneration unit, as the plant at Bristol had been in operation only three days. He was especially interested in Swindon's even load throughout the year, and wondered how it was achieved. It would also be interesting to know on what basis the benzole was sold, whether it was the "flask" or retort test. He would like to know how the relative carburetting values of the heavy oil from distillation and gas oil for water gas manufacture had been determined, and, further, could Mr. Chester tell him whether when dried gas was washed, any re-saturation of the gas occurred from residual water in the regenerated oil. He thought that the removal of a large percentage of the organic sulphur which could be reckoned as carbon disulphide would in itself account for the decrease in specific gravity of the washed gas.

Mr. A. Barrett (Frome) asked whether, when advantage was taken of the reserve therms by temporarily relinquishing washing for benzole, extra steam was used in the retorts to bring the calorific value back to normal; also what the capital expenditure given as £600 constituted. Had any allowance been made for extra retort plant necessitated in dealing with the extra coal, as he thought this ought to be included. In the case of the makes given by coal from different sources, were the throughputs the same in each case?

Mr. R. Robertson (Bristol) said it was a controversial point whether the benzole recovered should be regarded as a new gas consumer or a new bye-product.

Mr. D. L. Copp (Exeter) said it appeared from the balance-sheet that the benzole plant had not been debited with additional wear and tear on coal carbonizing and handling plant. In his opinion some allowance ought to be made.

Mr. Hole stated that the laboratory tests gave 3 gallons of benzole per ton of coal, whereas in practice only 2 gallons were recovered. How was this accounted for?

Mr. S. S. Lloyd (Weston) asked whether any trouble with service governors and services had been experienced as a result of benzole recovery.

Mr. J. E. Akroyd (Swindon, G.W.R.) asked if any figures

could be given regarding the active carbon process for benzole recovery from vertical retort gas.

Mr. K. L. Clark (Weston) inquired whether the revenue given was a net figure, handling and carriage charges having been deducted, and whether any trouble had been experienced with gum deposits in thermostats at Swindon.

The Author's Reply.

Mr. Chester, in replying to the various questions, said the explanation of the even daily load was that it consisted chiefly of cooking and water heating. The gas fire load was small, and had only been developed this winter. Its influence in unbalancing the load had already been noticed—in fact, the reserve of therms available through benzole recovery had to be augmented by water gas on one occasion during this winter. The benzole was sold on the old retort method, but the whole question of the selling price was under consideration at the moment. The amount of heavy oil left in the gas oil was adjusted by regulating the thermostat. Its value in carburetted water gas manufacture had been determined by mixing 20% of regenerated oil with new oil, when no decrease in heat units had been observed.

Better washing efficiency was obtained with dried gas, but he had no intention of drying, as his plant for benzole, which was installed with a guarantee to remove 1·5 gallons per ton of coal was regularly removing a little over 2 gallons per ton. The plant was not of sufficient size to remove the whole of the benzole, as in the laboratory test. A larger plant would have been installed in the first place if it had been desired to do this. He favoured leaving some hydrocarbons in the gas to make it easy for consumers to see when flat flames in water heating apparatus were alight.

When making use of the reserve of therms by by-passing the benzole plant extra steam was used on the retorts. The question of allocating some capital and wear and tear charges of the carbonization plant to benzole recovery was a debateable point. He thought there was no need to do this, as the overhead charges of the works were reduced by keeping the plant more regularly in full operation. The condition of the retorts and settings was improved by regular use instead of masking-off, as would be the case were benzole recovery not practised. The removal of sulphur along with the benzole had a beneficial effect on gas from a consumer's standpoint, and probably accounted for the decrease in specific gravity. He had not experienced any trouble with services or governors since recovering benzole, nor had he trouble with gum deposition. With regard to the active carbon process, it was expensive to install and costly to operate, though a purer product was obtained.

Mr. S. G. Watson (Messrs. W. C. Holmes & Co., Ltd.) raised a point about the reduced sulphur compound in the washed gas; and in dealing with the question of washing dried gas said that, as long as the steam pressure at the regeneration unit was between 90 and 100 lbs. per sq. in., there should be no appreciable rise in dewpoint of the gas during oil washing. As far as the active carbon process was concerned, he would refer the speaker to a paper by Mr. Blackburn, of Devonport, in which details were given of a complete recovery oil washing plant. The benzole produced was, he believed, better than some active carbon benzoles. The work needed to operate an active carbon plant was a serious point.

Vote of Thanks.

Mr. A. Barrett (Frome) proposed, and Mr. E. A. Smith (Bath) seconded, a vote of thanks to Mr. Chester for his paper.

NOTES ON PLANT AND PROCESSES

The C.G. "Burna" Gas Calorimeter.

On the stand of the Horstmann Gear Company, Ltd., in the Gas Section of the British Industries Fair at Castle Bromwich is a very interesting portable gas calorimeter, recently placed on the market by Mr. Charles Gray, of 49, Grange Road, Leigh-on-Sea.

A remarkable story attaches to Mr. Gray's efforts to set up his invention as a commercial proposition. Two years ago Mr. Gray commenced, in his spare time, to create an instrument which could be easily carried about for testing the calorific value of any gas supply at any point. Having completed and tested his invention, and finding that it fulfilled everything asked of it, he set out to act as his own "commercial traveller." Having travelled some 2,000 miles on foot, he had done sufficiently well to enable him to establish a small factory, where he is now producing the instrument on a more extended scale.

The C.G. "Burna" gas calorimeter, as it has been named, enables a workman of no technical knowledge to check up in ten seconds the value of the gas being made. Simplicity and cheapness are its outstanding points, and the results obtained are stated to be within ± 5 B.Th.U. with a gas pressure of at least 2 in. W.G. available at the burner.

The apparatus, which is neat and compact, consists of a bunsen burner fitted below the cone and barrel with a disc, which is capable of being revolved on a micrometer screw, thus causing a regular increment in the amount of air admitted to the barrel. The zero position is capable of being adjusted and fixed by means of a set nut, and the graduations on the disc are calibrated against actual calorific values. The gas pressure is regulated to a constant pressure before both calibration and use by means of a tap and pressure gauge.

The invention relates substantially to the admission of the air to the burner by means of an adjustable and graduated disc which controls the air inflow, the gas being admitted to the burner through an adjustable but standard orifice. The burner provides a ready means of checking the quality of the gas quickly and accurately. The air regulator is set at zero, when the air is completely shut off at the base of the burner. This is achieved by moving the jet regulator up or down after releasing the set nut and re-tightening. This zero point being fixed, all that is then required is to turn his graduated disc slowly to admit air until the gas commences to pop and continues to do so. The indicator then points to the reading on the disc which shows the calorific value of the gas.

The instrument, which has, we understand, already been tried out by several gas undertakings, is so portable that it can be connected to a gas supply at any point on crude gas, straight coal gas, water gas, coke oven gas, &c., and in each case it is claimed to give a quick and accurate reading of the calorific value of the gas passing at the time. It also has the advantage that it can be taken about the district to test the value of the gas at any point within an undertaking's area of supply.

Each instrument is checked before leaving the factory against a standard calorimeter, so that it only requires the setting of the calibration stud to suit individual conditions.

"Gunite."

A Handbook on Cement Gun Work.

In spite of the rapid progress of the cement-gun, or gunite, process of treating old and new concrete work, and the many remarkable instances in which it has enabled repair work to concrete, steel, cast-iron, and timber structures to be carried out satisfactorily, expeditiously, and economically, there is very little published information on this subject available in a handy form for reference.

A book just published by the Concrete Proofing Company, Ltd., of 100, Victoria Street, S.W. 1, dealing with all the phases of gunite work, will therefore fill a gap in the literature of concrete, and will serve a useful purpose in describing the cement-gun process and in putting on record the methods employed on some recent contracts of more than usual interest.

The book describes a few of the more interesting of the structures which have been strengthened, repaired, and waterproofed with the use of the gunite process, and the subjects covered include the reconditioning of reservoirs and water towers, the repair of marine structures, such as jetties, sea walls, and the encasing of timber piles, and tunnel and culvert linings. Regarding the latter applications, it is interesting to note that an interior finish of cement-gun rendering was applied over the whole surface of the Mersey Tunnel above the roadway, with the exception of a dado 7 ft. high—a total distance, including the two dock branch tunnels, of 2·62 miles. The gross area treated was approximately 80,000 super. yards, the under-river section being 1 in. thick, and the land approaches ¾ in.

The most notable characteristics of the gunite operation are that the materials—a dense, finely-graded cement—are "blown" into position under pressure in a continuous stream by means of the pneumatic gun and the quantity of water is kept to the minimum necessary for hydration. The combination of high pressure and a minimum of water results in the production of a homogeneous concrete of very high density with lasting qualities of adhesion to the surface to which it is applied.

The book gives full particulars of the material and proportions of the cement and the methods of operation, while some interesting test results regarding compression, tensile strength, and adhesion are included, the last-named experiment showing clearly that the bond between the gunite and the concrete to which it is applied is much stronger than the strength of the concrete itself. A useful index is also included at the end.

Industrial Gas Heating*

By Peter Lloyd, B.A.Cantab., A.I.C., Gas Light and Coke Company.

It is common knowledge that the industries and trades in which gas is used are numbered in hundreds and that the individual processes which it performs are numbered in thousands. This knowledge, backed up by the idea that each industry has its own special requirements, has given the impression in some quarters that the sphere of industrial heating is a vast uncharted region subject to no law except the rule of thumb. For this reason there is sometimes a tendency to emphasize the practical and neglect the theoretical aspects of the subject. But in spite of this variety of processes and industries the use of gas for industrial heating is in some ways a very simple matter, for it consists, after all, in the straightforward application of a flame either directly or indirectly to the object which is to be heated.

It may perhaps be this apparent simplicity of gas heating methods which has led some people to think them obsolete by comparison with the more complex operations involved in electrical heating. There is undoubtedly something of the mysterious and romantic about the generation of heat without flame as in the electric heating element, and this is further emphasized in the process of induction heating in which heat may be generated in a body without any external contacts whatever. If, by contrast, the methods of heating with gaseous fuel appear dull and prosaic, it is well to remember that the simplest gas flame is in fact composed of a series of complex physical and chemical changes occurring with extreme rapidity, which still remain largely unknown quantities and which still offer the scientist considerable food for thought.

Before considering in detail the application of heat to any special industrial problem it is desirable to examine the subject as a whole and classify it as far as possible. This has been done in Table 1, which shows industrial heating operations divided into three main groups—the heating of solids, liquids, and gases respectively, the heating of solids and liquids being further sub-divided into incandescent processes—that is, processes taking place at temperatures above a black heat, and low-temperature processes. This latter distinction is not, of course, a fundamental one, but it will be found convenient in analyzing the methods of heat application. The final column in this table indicates a few of the heating operations which fall in the various groups. They must be taken as a representative rather than an exhaustive selection. But, condensed as it is, the table shows clearly enough that we have to deal with groups of problems of many different kinds, and it is easily understandable that standardized industrial operations and cut-and-dried methods of heat application can never be satisfactory in dealing with them.

Table 1.

		Examples of Appliances Used.	Examples of Processes Carried Out.
I. Heating Solids	Ia. Incandescent processes (at temperatures above a black heat)	Muffle furnaces Oven furnaces	Heat treatment of metals. Vitreous enamelling. Pottery firing. Roasting ores.
	Ib. Low-temperature processes (below incandescence)	Ovens Drying plants	Stoving enamels. Bread and biscuit baking. Moulding plastics. Annealing glass.
II. Heating Liquids	IIa. Incandescent processes	Crucible furnaces Salt baths	Melting metals (brass, copper, gun metal, aluminium, &c.). Heating salt pots for case hardening. Glass making.
	IIb. Low-temperature processes	Steam boilers Evaporators Oil boiling furnaces	Melting lead, type metal, &c. Steam raising. Evaporating and concentrating liquids. Varnish making, gum running, and oil boiling.
III. Heating gases		Hot air generators Steam superheaters	Air conditioning. Drying. Room and factory heating.

In all these industries, and in almost all the processes connected with them, methods of heat application have been fully investigated and considerably developed in the course of the last 10 years, this development being mainly in two directions—

(i.) Towards increasing convenience.
(ii.) Towards increasing thermal efficiency.

The increased convenience of up-to-date industrial apparatus is manifested in terms of improved appearance, automatic control, continuous operations, and so forth, but in this paper we are more particularly concerned with the increases in thermal efficiency which have been taking place at the same time.

The Importance of Thermal Efficiency.

From the point of view of the Gas Industry the importance of thermal efficiency need not be stressed. It is well known that this is the measure of the

$$\frac{\text{Heat absorbed by the work}}{\text{Total heat input}}$$

and that it governs the quantity of fuel required for a given job. Where a number of different fuels are in competition this thermal efficiency must therefore be one of the first items to be considered.

Table 2.

Fuel.	Gross C.V.	Cost per Therm.	Calculated At -
	B.Th.U./Lb.	d.	Per Ton.
Coal	15,000	0·89	25s.
Coke	13,000	1·24	30s.
Fuel oil	19,000	2·11	75s.
	B.Th.U./C.Ft.		Per 1000 C.Ft.
Producer gas	150	2	3d.
Town gas	400–600	3–8	1s. 3d. to 3s. 4d. (500 B.Th.U.)

It is at once obvious from a consideration of Table 2 that there are fuels available which are greatly cheaper than town gas, and which, apart from considerations of efficiency and convenience, would normally be preferred to it. It is only by maintaining its efficiency and convenience in advance of these other fuels that gas is able to exist in competition with them. It is for this reason that there has been such a great drive in recent years to increase the efficiency of gas-fired appliances, and in the sphere of industrial heating which we are considering remarkable improvements have been effected in many cases. In a number of processes it has been found possible to reduce the gas consumption by fully 50% by using up-to-date equipment, and in some cases even greater economies of fuel have been obtained.

The Determination of Thermal Efficiency.

Thermal efficiency has already been defined as

$$\frac{\text{Heat absorbed by the work}}{\text{Total heat input}}$$

but with industrial appliances this quotient is much less easily measured than with the majority of domestic appliances. A hot water circulator, for instance, can only be used for one purpose—namely, the heating of water—and it is a simple matter to estimate the useful heat in terms of the two quantities—

(i.) Amount of water heated in unit time.
(ii.) Temperature rise of water in passing through heater.

An industrial appliance, on the other hand, can often be

* From a paper before the London and Southern District Junior Gas Association, Feb. 16, 1934.

used for a variety of purposes, and for any one process the efficiency may be largely dependent on the manipulation. As an example, consider a small muffle furnace. This can be used for a whole variety of purposes; for instance:

(*a*) Assaying precious metals.
(*b*) Hardening steel.
(*c*) Calcining inorganic salts.
(*d*) Testing heat-resisting materials.
(*e*) Enamelling, &c.

It is clear that the amount of heat usefully employed in any one of these processes bears no absolute relation to that usefully employed in any other. This process of assaying, for instance, consists in the reduction of a small quantity of ore containing precious metals by heating it in a furnace in the presence of borax and litharge. This has the effect of separating out the siliceous matter in the ore in the form of a slag, and leaving the precious metals gold and silver alloyed with a bead of metallic lead which is easily separated from the slag. The second part of the assaying process, known as cupellation, consists in heating the button of lead on a bone-ash cupel in a furnace having a strongly oxidizing atmosphere, the effect of this being to oxidize the lead to litharge, in which form it is partly absorbed by the cupel and partly removed by the air purge. A small bead of metal finally remains consisting of metallic silver and gold only. Now the thermal efficiency of the furnace used for this operation depends almost exclusively on the number of assays carried out and hence on the manipulation, since the heat usefully employed is virtually the same in each individual assay. In this case then, we arrive at the discouraging conclusion that the furnace as such cannot be said to have any particular thermal efficiency, and that even for this purpose the thermal efficiency is not a significant quantity. Exactly the same considerations apply to the other operations mentioned, and it follows that even for given processes it may be difficult to define and measure efficiencies. In spite of these difficulties, however, the definition of efficiency given above is the only one which can be judged satisfactory.

The significance of efficiency in industrial operations may be illustrated by considering a few actual efficiency determinations in representative processes.

(1) *Carburizing.*

Carburizing, as you may know, consists in supplying carbon to the surface layers of steel, which may be effected by packing it in carbon granules or some similar compound and heating at a certain temperature for a length of time—say, 12 hours. The carbon from the compound is able at this temperature to form a solid solution with the steel and to penetrate the surface of the latter to a certain depth. In this case the weight of material heated is made up of the steel undergoing treatment, the carburizing compound, and the box in which the whole is contained. The estimation of efficiency depends, of course, on whether the useful heat is taken as that contained in the steel alone or as that in the whole weight of material heated, and in considering thermal efficiencies of carburizing furnaces it is very important to ascertain which method of calculation has been adopted. Another variable factor which tends to make comparison difficult is the time of carburizing, which depends on the depth of penetration or "case" required and on the compound used. Obviously it is easier to get good efficiency figures for a 6-hour carburizing period than for a 12-hour period. The following example shows the type of result obtained:

Carburizing Efficiency Test.

Average weight per charge	900 lbs.
Average time in furnace	6 hrs.
Depth of case	1 mm.
Total weight of load including pots, compound, and clay put through furnace in one week	17,397 lbs.
Total weight of steel carburized in one week	9,780 lbs.
Total gas consumption over one week	58,495 c.ft.
Average gas consumption per pound of total load	3·36 c.ft.
" " " " " steel treated	5·98 c.ft.
Operating temperature	920° C.

Assuming the specific heat of the steel to be 0·153 and that of the remainder of the load to be 0·2, the thermal efficiency becomes as follows:

$$\text{Gross thermal efficiency} = 100\left(\frac{0{\cdot}562 \times 0{\cdot}153 \times 1{,}628 + 0{\cdot}438 \times 0{\cdot}2 \times 1{,}628}{3{\cdot}362 \times 500}\right) = 16{\cdot}8\%$$

$$\text{Net efficiency} = \frac{0{\cdot}153 \times 1{,}628 \times 100}{5{\cdot}98 \times 500} = 8{\cdot}3\%.$$

(2) *Metal Melting.*

This is a more straightforward process which allows comparison to be more easily effected, for the heat usefully employed may be very simply estimated as the total heat of the metal at the casting temperature, this total heat being composed of the sensible heat + the latent heat of fusion. In the case of the metals, lead, brass, copper, and aluminium, these total heats at the melting point are as follows:

Metal.	Total Heat of Molten Metal Above 60° F. at the M.Pt.	M.Point.
	B.Th.U./Lb.	°C.
Lead	29	327
Brass	240	970
Copper	295	1,084
Aluminium	464	657

The efficiency measurement of metal melting furnaces is illustrated by the following example of a lead dipping pot used for casting accumulator plates:

Average gas requirement to heat from cold to 850° F.	790 c.ft.
" amount of lead dipped per hour	883 lbs.
" gas consumption per hour to maintain 850° F.	256 c.ft.
" number of hours worked per day	6 hours

$$\text{Efficiency for continuous working} = \frac{883 \times 35{\cdot}8}{128{,}000} \times 100\% = 24{\cdot}7\ \%$$

And gas consumption per pound of metal melted = 0·29 c.ft./lb.

Over the whole day (*i.e.*, including the gas consumed in the original heating up)

$$\text{Efficiency} = \frac{883 \times 6 \times 35{\cdot}8 \times 100}{(128{,}000 \times 6) + 395{,}000} = 16{\cdot}3\%$$

And gas consumption per pound of metal melted = 0·44 c.ft./lb.

It must be realized that much higher efficiencies can be obtained with melting furnaces as opposed to dipping furnaces such as that described.

(3) *Bread Baking.*

This is a case in which the estimation of the heat usefully employed is less simple; it consists in the heat required to raise the temperature of the loaf to the value finally attained in the baking process and in the heat required to evaporate a certain proportion of water from it. The average temperature of the loaf on leaving the oven is approximately 200° F., and the amount of water evaporated is about 2 oz. per 2-lb. loaf, the combined heat requirements being therefore about 430 B.Th.U./2-lb. loaf.

The best figures so far obtained for bread baking with gas may be taken as 1·5 therms per sack of flour (186 2-lb. loaves), which gives 1·61 c.ft./2-lb. loaf.

The thermal efficiency thus works out as—

$$\frac{430 \times 100}{1{\cdot}61 \times 500} = 53{\cdot}4\%$$

(4) *Oil Boiling.*

Oil boiling is part of the process of varnish manufacture which consists in heating raw linseed oil to a temperature above its flash point (and incidentally very close to the point of spontaneous combustion) and allowing it to mature at this temperature. During this period chemical reactions take place within the oil (polymerization and condensation) which lead to a thickening of the product and which incidentally evolve heat. Consequently the heating-up curve of an oil boiling pot, instead of being concave to the time axis, is practically a straight line—in fact, it is possible to raise the oil through the last 50° F. without any application of heat. Under these conditions it is readily understood that the fuel for this process must be very easily controllable in order to minimize fire risks. In this case, therefore, to obtain a true estimate of efficiency it becomes necessary to take into consideration the heat evolved in the exothermic reaction taking place in the oil, and the efficiency equation may be written in the form—

$$\text{Efficiency} = \frac{\text{Sensible heat of oil} - \text{heat evolved by oil}}{\text{Total heat in gas burnt}}$$

(5) *Firing Ceramics in Tunnel Kilns.*

Another somewhat abnormal case is provided by the process of firing ceramics in double-tunnel kilns. This consists in passing two trains of pottery through a tunnel system heated over a limited section in the centre so that after passing through the heated zone the hot material is able to give up its heat to the other train which is travelling in the opposite direction and has not yet been through the hot zone. This process is known as load recuperation, and its interest for us lies in the fact that, on our definition of efficiency, it would seem to make possible efficiencies of over 100%. Unfortunately its applicability is limited.

Factors Affecting Efficiency.

Before considering the factors affecting thermal efficiency it is necessary to point out that the definition of this

quantity may, if desired, be expressed in an alternative form—

$$\text{Thermal efficiency} = \frac{\text{Total heat input} - \text{total heat loss}}{\text{Total heat input}}$$

From this inverted formula we must draw the obvious conclusion that any reduction in the total heat loss increases the overall thermal efficiency. As we are interested in increasing thermal efficiencies of appliances it becomes necessary to consider the item total heat loss, and if we do so we shall find it to be composed of a number of factors as follows:

(i.) Direct radiation from flames.
As an example of this consider a vertical steam boiler without any reflector plate at the bottom. Obviously any radiation falling on the ground will tend to be dissipated by conduction and will therefore be lost.

(ii.) Loss by conduction through walls.
However well insulated a furnace or oven may be its surfaces will ultimately rise to a temperature in excess of the surroundings and heat will consequently be lost from the structure.

(iii.) Loss of heat stored in walls or other furnace parts or in some heating medium.
This form of heat loss is limited to discontinuous operations, and it is this which makes certain thermal efficiencies dependent on the length of time for which the operations are carried out. As an elementary example consider any installation heated by steam—say, a set of bakelite moulding presses. In order to heat one press it becomes necessary to raise the temperature of the whole of the water in the boiler and the resultant efficiency is obviously low.

(iv.) Flue losses.
These are common to all gas appliances.

At this stage it must be pointed out that a reduction in any one of these items of heat loss will not necessarily result in a proportionate reduction of the total heat loss, for it may bring about an increase in some other form of heat dissipation. For instance, the reduction or elimination of heat loss by radiation from flames will normally tend to give an increased loss of heat by conduction through walls.

Heat Loss by Radiation from Flames and Hot Gases.

This form of heat loss is at once the most serious form of potential heat loss and the most easily eliminated, and in modern appliances it has now been avoided in almost every case. It is only in such processes as brazing and welding, which must of necessity be carried out in the open, that the naked flame continues to be used, but, although this form of heat loss is no longer general, it is still necessary to appreciate the importance of radiation from flames and hot gases in the design of industrial appliances, and this radiation has been the subject of extensive investigation. It has been found that the heat radiated from a flame depends not only on its character—*i.e.*, whether it is luminous or aerated—but also on its size, and flames burning in the open radiate approximately 10-15% of their total heat input. But as soon as the flame is enclosed, and the flow of air is reduced, the chilling of the hot products of combustion by mixture with cold air is largely eliminated, and under the controlled conditions obtained in modern heating appliances the amount of heat radiated must be taken as considerably in excess of the figure quoted for the open flame. It is only on this basis that it is possible to explain the very intense heat transference which takes place in the neighbourhood of a flame burning near cold surfaces.

Heat Loss by Conduction Through Walls.

Of the three processes of heat transmission that of conduction is governed by the simplest basic formula:

$$H = \frac{Ak}{d}(t_1 - t_2)$$

where H = heat transmission in B.Th.U. per hour.
d = thickness of section.
k = thermal conductivity.
$t_1 - t_2$ = the two surface temperatures.
A = area of surface.

But this formula by itself is of little practical value, for the case of which it treats, the transmission through a plain slab of uniform thickness, of material with constant temperatures on each face, is one that is very seldom obtained in practice, and as soon as the other variables are considered we find that the calculation of conductivity problems is considerably less simple than at first appeared. The first additional variable to take into account is the shape of the body through which conduction is taking place, and for simple shapes, such as spheres or long cylinders, standard formulæ can easily be derived. In the case of the sphere, for instance—

$$H = \frac{2\,k\,ab\,(t_1 - t_2)}{b - a}$$

where $t_1 - t_2$ are the temperatures at the radii a and b, and where the heat flows radially outwards from the centre of the sphere. In practice the shapes of furnace walls are considerably more complex than these elementary geometrical figures and exact solutions of the type given above for a sphere cannot be obtained. The difficulty is overcome by applying suitable correction factors to the elementary formula. Consider, for instance, the conduction through a cubical box having a uniform temperature on the inner surface. The conduction through this would, if the edges and corners were neglected, be proportional to $\frac{A}{d}$,

where A = area of the inner surface
d = thickness of the wall

but in fact these edges and corners will definitely increase the flow of heat through the system. The conduction has been found to be proportional to—

$$\left(\frac{A}{d} + 0{\cdot}477l + 0{\cdot}151\ dn\right)$$

where l = total length of the outside edges
and n = number of corners
= 8 in this case.

The flow at an edge is illustrated by fig. 1 showing a section through a square edge with the flow lines and

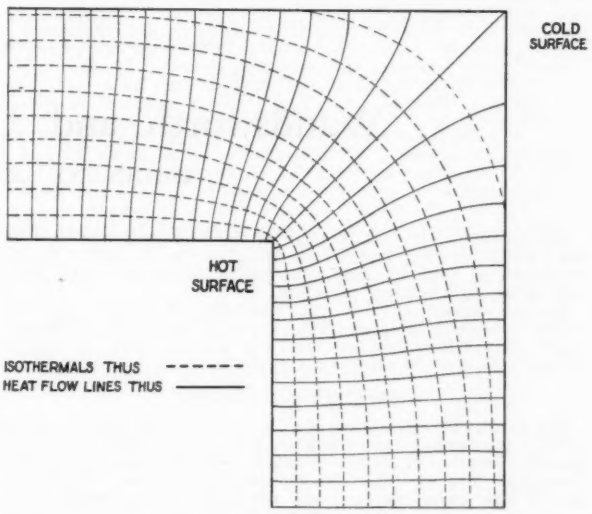


Fig. 1.—Heat Flow at a Rectangular Edge.

isothermals sketched in. The correction factors have been calculated theoretically and confirmed in practice making use of the analogy between thermal and electric conduction. A more general formula applicable to all cases in which all interior dimensions are $> d/5$ is

$$H = k\,(t_1 - t_2)\left(\frac{A}{d} + 0{\cdot}541 + 1{\cdot}2d\right)^*$$

It is important to note that it is definitely not satisfactory to use the simple shape factor $\frac{A}{d}$ and to express A as either the arithmetic or geometric mean between the inner and outer surfaces. To do this gives results considerably in excess of those actually obtained. The heat loss by conduction from an appliance therefore depends on three things:

(i.) The temperature on the inner surface.
(ii.) The temperature on the outer surface.
(iii.) The shape and conductivity of the refractories and insulators.

The second conclusion to which we are forced by these considerations is that the heat loss by conduction will be most important on furnaces working at high temperatures, for in ovens and low-temperature appliances the quantity $(t_1 - t_2)$ will be low, and unless the exposed area be very great the resultant heat loss will not be considerable. In practice it is found that while the insulation of a boiler or an oven may increase the thermal efficiency by 10-15% the insulation of a furnace may easily increase its effici-

* See Langmuir, Adams, and Meikle, Transactions of the American Electro-Chemical Society, 1913, Vol. 24, p. 53.

ency by 40-50%. It also follows that the higher the temperature on the outer surface of the insulation the smaller will be the loss of heat by conduction. This temperature t_2 will in turn depend, for a given furnace, on the nature of the surface and the temperature of the surroundings. If we assume the temperature of the surroundings to be constant the nature of the surface remains the controlling factor. The relationship between the heat loss from an irregularly shaped body at various temperatures and the emissivity of its surface is illustrated by the following table:

TABLE 3.

Temperature °F.	Heat Loss from Irregular-Shaped Body. B.Th.U./Sq.Ft./Hour.		
	(a) By Convection.	(b) By Radiation. E = 1.	(c) By Radiation. E = 0·5.
80	13	22	11
100	30	44	22
120	50	68	34
140	72	97	49
160	94	128	64
180	119	161	80
200	145	200	100

When we consider the fact that the emissivity of a dull black surface may be ten times that of a polished metallic surface it becomes clear that the use of the polished metal may appreciably reduce the heat loss from appliances, particularly if they are working at high temperatures. This is a case where the interests of efficiency are in direct conflict with those of convenience, for a metal casing which by reason of its low emissivity has been unable to lose heat rapidly will have reached a high temperature, and, having a high conductivity, will have become very unpleasant to handle. The effect is emphasized by the fact that the metal which is most suitable for producing the polished non-radiating surface—namely, aluminium—has an abnormally high conductivity.

As regards the shape and conductivity of the refractories and the insulation of a furnace, these must be decided according to particular circumstances. The guiding principle must be to use at every position bricks having the minimum permissible conductivity, this being limited by the tendency of insulating bricks to deteriorate at high temperatures either by shrinkage, disintegration, or ultimately by fusion. It may perhaps be mentioned that insulation of furnaces can in certain circumstances have unfortunate results. It has been tried, for instance, on the large glass melting furnaces known as tank furnaces, which form great baths of molten glass heated from above to temperatures of the order of 1,400° C. When insulation was applied to these furnaces in an attempt to reduce their fuel consumption it was found that it raised the temperature of the inner refractory wall to such an extent that it was destroyed, with results which may be left to the imagination. For this reason tank furnaces are still built without any insulating material.

(To be concluded.)

Wandsworth and District Gas Company

ORDINARY GENERAL MEETING

The Ordinary General Meeting of the Company was held at the Chief Office, Fairfield Street, Wandsworth, London, S.W. 18, on Tuesday, Feb. 20, 1934—Mr. FRANK H. JONES (Chairman and Managing Director) presiding.

The SECRETARY (Mr. W. H. Cromarty, F.C.I.S.) read the notice convening the meeting, together with the Auditors' report on the Balance-Sheet, and the minutes of the preceding Ordinary General Meeting were taken as read.

CHAIRMAN'S ADDRESS.

The CHAIRMAN, presenting the Directors' report and accounts for the year ended Dec. 31, 1933, first called attention to the fact that October of this year would mark the centenary of the Company. The capital of the Company in 1834 was £5,000; to-day it was £4,000,000, and the Company served 160,843 consumers and employed 2,500 people. It was absorbing to conjure up in the mind the various activities which had marked the Company's course of progress and efficiency during those years, and all honour was due to those who had so wisely guided the Company in the past.

The year under review, he continued, had been very exceptional—it was a day shorter than 1932, and there were 14 days more of "summer time" in 1933 than in 1932 (clocks were put back an hour for a period which was 14 days longer). In addition, the weather had been exceptionally mild for at least nine months of the year, so that it did not favour the Company in regard to the output of gas. In fact, statistics showed that the temperature was 1° higher throughout 1933 than during the preceding year—and from a number of years' experience it had been found that 1° rise or fall in temperature caused approximately 1% increase or decrease in the amount of gas sold. Therefore, the decrease of 1·2% indicated in the report was practically disposed of on this basis—even forgetting that there was one more day in 1932 than in 1933.

The Directors and Officers were proud of the fact that during the year they had increased the number of consumers by 7,290, making a total of 160,843. With these additional customers it would appear reasonable to expect an increase in the sale of gas; but it should be borne in mind that the majority of these consumers were using the most modern apparatus, and also that 21,488 major gas appliances had been installed in consumers' houses in the year. Owing to research and improvements in the design of apparatus during the last few years, the efficiency of both cookers and fires had increased very materially, and, therefore, while consolidating the position of the Company, the installation of modern apparatus in place of appliances of older design had had the effect of reducing the consumption per consumer. In other words, the consumers were using gas to the same extent for their comforts, but more economically than heretofore.

EXPANSION OF BUSINESS.

During the last three years the Company had secured 21,223 additional consumers and had laid 134 miles of additional mains. That was why the Company was spending so much money. He could not think that that was wrong; indeed, the Board saw no alternative than to go on spending money and getting more business.

The capital account showed that during the year there had been issued £275,000 of 5% preference stock, at a very favourable price. This was necessitated by the large expansion which had taken place on developing a large area of supply.

Referring to the statement of loan capital, the Chairman drew attention to the fact that the total loan capital authorized was a little less than was shown a year ago. This was due to the fact that the Company had issued £250,000 preference stock just prior to securing its last Order through the Board of Trade, and that sum was not considered in the Order when the amount was fixed; thus, the Company was deprived of the authorization of loan capital to the extent of 60% of the amount received for that issue. However, this was a small matter, which would be rectified when next the Company applied for further powers.

The capital expenditure shown on the balance-sheet had been undertaken only after the closest scrutiny and consideration by the Directors. It had been the policy of the Company to keep the works and district in first-class order, and the river wall at the works, to which he had referred last year, had been completed in accordance with the recent flood prevention enactments. It replaced the old wall and was a first-class engineering job; further, by its construction there was added between three-quarters and one acre of land which would be valuable to the Company, and the flow of the river was improved.

The new discharging pier in the river was practically completed, and it would do away with the old method of discharging coals, whereby the ships came alongside a pontoon on which cranes were erected; the cranes transferred the coals from the holds of the ships to barges, which latter were hauled ashore, the coals being again handled by more cranes and placed into the coal stores. It had always been the wish of the Directors to substitute this operation by a cheaper and more efficient method, and with the completion of the pier this wish would be realized. The expenditure would not have been justified if there had not been the amalgamations with the Kingston and Sutton undertakings, &c., but the quantity of coal now carried justified the expenditure.

A benzole recovery plant had been installed during the latter part of the year. It was now working efficiently, and it was anticipated that considerable additional profit would be derived therefrom. This profit would be obtained without any adverse effect upon the gas supplied to the consumers. The output was 2,500 gallons of benzole per day.

GRADED FUEL.

It had become more and more necessary to provide first-class graded fuel for the large number of coke-fired heating appliances being installed in private houses, and in many cases for the installations of automatically fed boilers used in large building schemes. In order to obtain the utmost efficiency it was necessary that this apparatus be provided with properly graded and screened coke, and the Company had practically

completed one of the finest coke-screening plants in London. The coke would be delivered to the screening hoppers by machinery and would be loaded into sacks with a minimum of manual labour.

The charge for mains and services was still a very heavy item of capital expenditure, but one which the Directors felt was imperative at the present time. The development of housing schemes in the Company's area was proceeding at an ever-increasing rate, and in order that the future tenants in these estates might be supplied with gas it was necessary to lay mains as the estates were constructed. In modern times more up-to-date methods were used by builders in developing these estates, for whereas in the past the last portion of an estate to be constructed was the roads, in order to obtain easier and more economical means for handling materials the builders now construct concrete roads before building operations are commenced; therefore, it became necessary for the Company to lay mains as soon as the roads were projected, in order to save expense and inconvenience—thus expending capital which had to remain idle until the houses were erected and occupied. A further source of expense was the necessity for laying mains on both sides of concrete roads to prevent laying cross-road services.

During the year under review the Company had laid no less than 55 miles of new mains. Owing to the development of the Company's area, many of the mains previously laid were too small to cope with the increased demand, and this had necessitated the laying of larger mains, which in turn involved the transfer of the services from the old to the new mains; this accounted largely for the expenditure under the heading of "Maintenance of Mains and Services."

With regard to "Stoves and Meters," the Company was one of the first to introduce enamel cookers and coloured fires on deferred payment terms. The Directors were convinced two years ago that this was an important factor in meeting the increasing competition from alternative fuels, and the results of the adoption of this class of apparatus had more than justified that view; but a reflection was, of necessity, shown in the capital expenditure as a result of this development. The modern housewife would not be content with old-fashioned apparatus, and if alternative gas apparatus were not available she would adopt another form of fuel for heating and cooking, despite the fact that gas was undoubtedly the cheapest, most efficient, and healthiest fuel for both.

Service to consumers was of paramount importance. Various facilities had been given in the way of new hire terms, extra appliances on hire purchase and limited hire. Also, various new apparatus and appliances had been placed on sale—notably coloured fires.

Continuous Accounting.

A new showroom had been built at Worcester Park and would be opened very shortly. A Cookery Demonstration Centre was in course of preparation at Wandsworth, and that also would be open to the public at an early date. The method of rendering gas accounts had been altered to a system known generally as "continuous reading," which led to economy. Lectures, exhibitions, demonstrations, &c., had been arranged at various halls throughout the Company's district, with and without the co-operation of other companies and societies, and the works had been visited by various societies and Press representatives.

Improvements to outside shop lamps had increased sales, and many buildings had been floodlighted with gas. In certain areas extra street lamps had been erected; all of which went to prove that the Company was still holding its own, especially when it was allowed fair competition—which, he regretted to say, was not always the case.

Referring to the revenue account, the Chairman pointed out that the credit side was controlled largely by the prices that could be obtained for by-products. The Company at all times tried to obtain the highest market prices for its residuals, but circumstances outside its control affected these markets to a large extent. For example, the price of coke had fallen during the year. This was to some extent due to the warm weather and also to the importation of "coke-oven" coke into the London area from the Midland and Northern regions.

Tar was still more sensitive, for not only did the domestic affairs in England affect the price, but residuals from refined tar were largely exported, and, therefore, prices were reflected by changing conditions abroad. In order to obtain the best possible price for tar and its products the Company had entered into an agreement covering a period of 14 years with Messrs. Crow, Catchpole, & Co., the well-known tar distillers. The Gas Company would provide Messrs. Crow, Catchpole, & Co. with the whole of its output of tar resulting from carbonization of coal, which the refiners would refine and sell through their organization, and the profit arising from such sales would be divided in agreed proportions between the Gas Company and the refiners. By this means it was anticipated that the Gas Company would at all times obtain the best prices for its tar and tar residuals.

Sulphate of ammonia still showed a small loss on manufacture, but prices were improving slightly, and the Directors hoped the improvement would be maintained.

During the year the price of gas was increased by 0·4d. per therm throughout the Company's area, and this increase was reflected in the accounts. The higher price did not reduce the dividends, and the prices charged by the Company still compared very favourably with those charged by surrounding companies.

The expenses in connection with the maintenance of works were somewhat heavy, but this had been caused largely at Wandsworth during the period of reconstruction of its vital machinery. The inconvenience caused by these large engineering undertakings had resulted in additional costs of working, but it was anticipated that considerable economies would result in the future by reason of the alterations now taking place. All the works of the Company had been maintained in first-class condition. The Epsom works was closed down in April last, and the Kingston works was closed during the summer months. Economies had been effected thereby, and he was pleased to be able to say that, although a large number of men were affected, the Company had been able to employ them economically on the laying of new mains, and only an absolute minimum of labour was dispensed with. The Kingston works was re-opened shortly before Christmas, and would be closed down again as soon as it was conveniently possible.

Record Output.

There was a record send-out of gas from the Wandsworth works during the cold weather in December, and in both the month of December and the December quarter the sales of gas were records in the history of the Company. That was comforting, as against the decrease of sales by 1·2% over the year. In January and December, 1933, the Company had done extraordinarily well; in October and November it did moderately well, but the summer months were very bad from the point of view of suppliers of heat and light.

There was no capital charge for ships in 1933, but they had been running very successfully, without any accident of note, and had brought all the coal required by the Company. A record delivery was made by the steamer "Wandle" during March, when seven cargoes of coal were loaded in the North and discharged at Wandsworth—a total tonnage of 14,906.

Reviewing the position of the Company generally, it might confidently be expected that the working costs would be reduced materially this year; but the service of the Company to its consumers was of paramount and increasing importance. Practically the whole of the apparatus sold in the showrooms at the present time comprised enamel cookers, which were pleasing in effect, and coloured fires which matched the decorations of the rooms for which they were intended. It was of interest that 523,595 customers had attended the Company's showrooms during the past year—an astounding figure.

The staff was working whole-heartedly in the service of the Company; £26,444 had been placed to the credit of the co-partners, and £24,106 had been paid in respect of superannuations and pension fund contributions.

With regard to the note on the balance-sheet, that a recent actuarial valuation of the pension fund had disclosed a substantial deficiency, caused in part by the fall in interest rates, the Chairman said the fund was started by the Company, with the sanction and approval of the shareholders, some ten years ago. It had been the custom of the Company for many years to grant a pension to employees when they became too old to be engaged actively in its service, and with the inception of the pension scheme the Directors had agreed that the previous service of the Wandsworth, Mitcham, and Epsom employees should rank for pension. In the case of the Kingston and Sutton employees, it was decided that the whole of their service should rank for pension, less the period during which the other employees had contributed to the fund since its inception.

The scheme was based on the best technical advice the Company could obtain at the time and was similar to those in operation in other public utility undertakings. In accordance with statutory requirements, the fund had been valued every five years by the Company's Consulting Actuary, and the last valuation had revealed a substantial deficiency, due to the earning power of investments having been very materially reduced. The Directors were taking steps to make the fund solvent over a period of years without inflicting undue cost on the revenue account. It meant that future employees of the Company would have to pay a little more, and the Company would have to pay a little more in respect of them.

Staff Facilities.

Every step was taken to keep the staff fully alive to the Company's interests and to provide the younger employees with facilities for making themselves efficient to take more responsible positions in the Company's service. With this end in view, courses of Salesmanship, Advertising, and Gas Fitting had been formed, and incentive was given to employees to prepare themselves for examinations.

The Directors looked forward to the future with confidence, and in supplying gas they felt that the Company was employing the most efficient utilization of coal for the national welfare. The Chairman urged that all the Company's stockholders should realize that they were potential crusaders in keeping the Industry to the fore, thereby swelling the national dividend, keeping thousands of men employed, maintaining a service second to none to consumers, and securing a good return for their money invested in such a large and important Industry. Even though not a consumer of gas in the Wandsworth Company's area of supply, one could help one's local gas company to maintain the traditions of an Industry which had played such a large part in the advance of our country.

Finally, in a reference to the proposed dividend of 7% on the consolidated stock, the Chairman said it might be pointed out that in order to pay that dividend it was necessary to take £20,363 from the carry-forward. He drew attention, however, to the fact that during the past three years the investments of the Company had increased from £129,364 to £150,457—*i.e.*, by £21,093—and, of course, during those three years nothing had been taken from the reserve and special purposes funds,

all of which were invested in gilt-edged securities. The reserve fund amounted to £45,290, and the special purposes fund to £71,400. He was not making excuses, but, knowing the Company's resources and the economies, he had no hesitation in saying that the Company could afford to pay the 7% dividend.

The Chairman then proposed the approval and adoption of the report and accounts, and in inviting Dr. T. A. Ives Howell to second, said that Dr. Howell's grandfather was one of the founders of the Company.

Dr. T. A. Ives Howell (Deputy-Chairman) seconded the resolution, which was carried, without discussion.

Dividends.

The Chairman proposed that dividends be declared for the six months ended Dec. 31, 1933, at £2 10s.% on the 5% preference stock and £3 10s.% on the consolidated stock, less income-tax, making the total dividends for the year 5% and 7% respectively.

The resolution was seconded by Mr. R. M. Chart, and carried.

Re-Election of Directors.

The Chairman, proposing the re-election of Mr. R. M. Chart and Mr. J. Bromley Howell to the Board (they having retired by rotation), said that Mr. Chart had been as helpful to him as had any other Director, and had a very wise head. Mr. Howell was another descendant of the Mr. Howell who was one of the founders of the Company.

Mr. G. F. Page, seconding, said that the stockholders could not elect two better men.

The resolution was carried.

Re-Election of Auditor.

The Chairman said that Mr. E. L. Burton, F.S.A.A. (the retiring Auditor), was connected with many companies, had been the Wandsworth Company's Auditor for a long time, and was thinking of retiring. At the Chairman's personal request, however, he had consented to offer himself for re-election.

On the motion of Mr. Potter, seconded by Mr. Green, Mr. Burton was re-elected.

Vote of Thanks to Directors and Staff.

Alderman Plumridge, J.P., proposing a very hearty vote of thanks to the Chairman and his co-Directors, and to the staff, said he had been connected with the Company for 54 years, as an employee and as a stockholder. He recalled that the Chairman's grandfather was Consulting Engineer to the Company 54 years ago, and that his father had served the Company also, while Dr. Ives Howell and Dr. J. Howell were carrying on the work of their ancestors. That had led to success and prosperity.

Mr. J. Young, seconding, said he was glad the Chairman had drawn attention to the £26,444 credited to co-partners during the year; it was a noble sum. He was also pleased that "little Epsom" had increased its gas sales by 6%.

The vote of thanks was carried.

The Chairman, responding, said it was almost a pity, from the Company's point of view, that Alderman Plumridge had left its service. Commenting on hints he had heard that the Chairmen of gas companies made excuses for not selling more gas, the Chairman advised the stockholders that when the Directors began to make excuses it was time to secure new Directors. The Directors of the Wandsworth Company gave reasons, but not excuses.

Mr. C. M. Croft, M.I.Mech.E., F.C.S. (Chief Engineer and General Manager), responding on behalf of the staff, said all of them realized that the prosperity of the Company was their principal concern, and in time of difficulty or otherwise they could be relied upon to do their utmost in the interest of the Company. On behalf of the staff also he expressed thanks to the Directors. The longer Mr. Frank Jones remained Chairman, the more the staff appreciated what a great Chairman, engineer, and organizer he was. There were five Committees of the Directors, covering all the operations of the Company, so it was obvious the staff could do nothing without the cognizance of the Directors.

At the conclusion of the meeting, the Directors and some of the stockholders visited the works, where they were able to see the "Wandle" unloading coal, the new river wall, and the benzole plant. Copies of the monthly magazine published by the Company was also available to stockholders at the meeting.

Tottenham and District Gas Company

ANNUAL GENERAL MEETING

The Annual Ordinary General Meeting of the Proprietors of the Tottenham and District Gas Company was held on Feb. 20, 1934, at the Chief Office of the Company, Woodall House, 658, Lordship Lane, Wood Green, N. 22—Mr. Henry Woodall, M.Inst.C.E. (Chairman and Managing Director), presiding.

The Secretary (Mr. Edward J. K. Fussell) read the notice convening the meeting, after which the common seal was affixed to the register of proprietors.

CHAIRMAN'S ADDRESS.

The Chairman said: I presume that you will take the report and accounts as read. [Agreed.]

You have all had copies of the accounts, and I hope you will consider them satisfactory. We are here accustomed to such good results that the figures for 1933 are a little disappointing. The reason for this is at once apparent, for we have lost our Wood Green Electricity Undertaking. Last year I gave you the story, so you were not unprepared.

It was unfortunate for us that we received the Consideration Money for our Electricity Undertaking at a time when money is cheap and earns but a small rate of interest. By our agreement with the Wood Green Urban Council we were only entitled to our capital expenditure *plus* 15%; there was no question of purchase based on maintainable profits. The result of the transaction is, that last year there was a loss of revenue of £17,631, and when this is realized I think you will be grateful to see that in spite of the reduction, we are able to pay our full statutory dividends, to add £5,629 to our reserve and special purposes funds, and only reduce our carry-forward by £2,813. It is true that we have had to call on the renewal fund, which was created for such a purpose, to the extent of £8,000, but the fund still stands at the substantial figure of £68,459.

An outstanding figure in the accounts is the general investment account, which last year stood at £68,878 and is now £223,588. This is due to the sale of the Electricity Undertaking.

Two Good Investments.

We found two good investments for some of our money—namely, the Hitchin Gas Company and the Stevenage Gas Company. The total cost of these Undertakings was £74,071. No profits from either of the Undertakings came into last year's accounts, but we shall have a full year's dividends to help us this year. I am sure you will approve of the Board's investment.

Referring to the accounts, there is no change in capital stock. With regard to loan capital, we have been able to redeem £4,100 mortgages.

On Statement "C" you will notice there has been a net addition to capital outlay of £31,593, and there you will also see the last reference to electricity showing a surplus on capital account of £49,241. I regret to say that the capital per million c.ft. sold shows a small increase from £449 to £461. We are fortunate at Tottenham to be able to report a slight increase in output, amounting to 8½ million c.ft. (this would have been larger by 12 million c.ft. had we not to compare with leap year and its extra day in 1932); although our addition to capital is small the increase in output is comparatively smaller.

Turning to statement "D," revenue account, the cost of coal and oil is less by nearly £10,000, due to the decreased cost of coal, and would be greater but for the tax on oil, which meant an addition of over £6,000. The tax has been to some extent compensated for by the assistance it has given us in competing with oil for some industrial purposes. The amounts credited to co-partnership and pension fund are larger, which is all to the good. There is little change in the other items on the debit side.

Public Lighting.

On the credit side we have a decrease of nearly £5,000 in receipts for gas, other than public lighting, due to a reduction of price in our Waltham area and to extension of discounts. Public lighting, however, shows a very satisfactory increase of over £4,000. The number of public lamps has increased from 8,897 in 1932 to 9,381, and the consumption shows an increase of 4·39%. You will be interested to know that we have obtained a seven years' contract for lighting the Cambridge Arterial Road, and at the present time there is a continuous length of this road lighted by us for a distance of nearly eleven miles. We are proud of the fact, and our officials are to be heartily congratulated upon it, as we have very severe competition from electricity.

You probably saw the other day, when the Wood Green Council were discussing the question of public lighting, the supply of electricity failed; but even under these conditions, you will hardly believe it, the electricians won the day. Your sympathy will be extended to our Chief Officers when such obvious guidance is disregarded. There is a good deal of talk about making people "Electrically Minded"—"Electrically Blinded" would better describe people who can see no merits in their rivals.

It is commonly thought that electricity has practically ousted gas for domestic lighting. Perhaps some of you saw in the speech of the Governor of the Gas Light and Coke Company that more than half the domestic lighting of London is still in the hands of the gas companies. I think that this will come

as a surprise even to many connected with the Gas Industry. In our district we still provide more than 90% of the public lighting and over 50% of the private lighting.

Gas lighting has a number of advantages. The light itself is particularly steady and reliable and of good quality. The replacement of mantles is less costly than the electric bulb. A certain amount of heat is generated, which is appreciated by those whose means are small. Some quite important industrial consumers have reverted from electricity to gas. It is found that not only is the light more evenly diffused, but its use enables considerable savings to be made in the cost of heating factories if gas is the basis of lighting.

What I want you to know is that we are particularly keen on the lighting load and are doing all we can to retain it, and our efforts are not unsuccessful.

The Smoke Evil.

Mr. O. A. Sherrard, Deputy-Secretary, Central Electricity Board, in an address to the members of the Town Planning Institute on Friday, Feb. 9, as reported in *The Times*, said: "Whatever principle of planning was adopted the most important lever would be electricity. We could get rid of the smoke evil in a generation by educating the architect to think in terms of electricity. We must think of chimneys as relics of a bygone style. Referring to road accidents, Mr. Sherrard said that he sometimes dreamed of the day when all the great trunk roads would be lighted with the new mercury vapour type of lamp."

Now, Ladies and Gentlemen, we all want to abate the smoke nuisance, and the Gas Industry has done more in this direction than the electricity industry has done or ever can do. Ordinary gas fires are very largely used and are quite satisfactory; but many people very naturally insist on an open fire, and with our coke fires they get what they want and still use a smokeless fuel.

One would assume that Mr. Sherrard visualizes houses warmed by electricity with no flues; I can hardly imagine anything more unhealthy and uncomfortable. Fortunately, our architects are practical men and will certainly not "think of chimneys as relics of a bygone style."

With regard to the lighting of roads, I think few unprejudiced people would suggest that electric is an improvement on gas lighting. Those of you who have seen the mercury vapour type of lamp will, I am sure, devoutly hope that Mr. Sherrard's dream will not come true. The jaundiced effect created by this type of lamp is most unpleasant and uncomplimentary.

New Retort Plant.

Last year we did a good deal of reconstruction of plant. We are obtaining most excellent results from the new intermittent vertical retorts, the chief item of reconstruction. This plant was inaugurated on Dec. 12 last by H.R.H. the Duke of York. We are very grateful to His Royal Highness for the encouragement his visit gave to all of us, and we are quite determined that the plant he inaugurated shall be a successful one. The test run is practically complete, and the results are highly satisfactory.

You will be glad to know that our pension fund is in a very sound condition. This fund was started in 1914, and was not to be operative for ten years; the fund has now been in operation for ten years, and during that time the amount distributed in pensions has been £42,000. The fund, to the extent of over 80%, is invested outside the Company, and amounts to £280,000. This is the book value, the market value being £318,000.

The allotments which you approved of last year which we were able to provide on some of our spare land at Tottenham, in conjunction with the Society of Friends, have all been taken up and are much appreciated by the unemployed working them.

The Future.

With regard to the future, though perhaps it is a mistake to prophesy, we have no immediate anxiety.

Our works are better equipped than ever. The district is growing in many directions, and all new houses have gas appliances of one sort or another. In some, though not in many cases, they are all-gas houses. Last year we added 4,384 consumers, and the growth this year to date has not decreased. We shall certainly make economies in working in 1934 over 1933.

The revenue will be increased by a whole year's dividends on the Hitchin and Stevenage Undertakings. There has been a satisfactory increase in the output up to date. Our industrial load is increasing. One consumer alone is using nearly 100 million c.ft. per annum.

We are selling more apparatus and of more varied character than ever before. Our coke sales in the district are steadily increasing. Coke fires lighted by gas are very popular. We have 4,000 in use. Our coal is now bought on a guarantee as to ash and moisture content, with the result that the coke is of excellent quality. There is unfortunately still a small loss on sulphate of ammonia (which we are bound to make in order to dispose of our ammoniacal liquor), but the loss is decreasing, and we hope later to turn the loss into a profit.

The benzole plant will be more fully occupied this year and the profits larger. Benzole production means the use of more coal, and reduces the amount of foreign spirit imported. The Gas Industry for this reason alone is of national importance. Taking all these points into account, I look forward with confidence to a successful year.

One other factor and perhaps the most important is that we have an excellent staff, and a body of able workmen interested in their work. You as shareholders have always approved most readily the schemes of the Directors to improve the conditions of our workpeople. Our co-partnership and pension funds and welfare association are very much appreciated by our employees from top to bottom. Our recreation ground and club house are kept in fine condition and are constantly in use.

With a growing business and a fine developing district, and all concerned working together for mutual advantage, there is every reason to have confidence in our Undertaking.

I now move:

> "That the report of the Directors and statement of accounts for the year to Dec. 31, 1933, be received and adopted and that the report be entered on the minutes of the proceedings of this day."

Mr. Thomas Goulden, M.Inst.C.E., seconded the resolution.

The Chairman: If you have any questions to ask I will do my best to answer them.

Mr. Lascelles, who said that he had been a consumer of the Company for 38 years, raised the question of meter rents, and the Chairman explained the position.

The resolution was then put to the meeting and carried unanimously.

Dividends.

Mr. Henry Bailey proposed:

> "That a dividend at the rate of 5½ and 5% per annum respectively on the preference stocks, and £6 15s.% per annum on the ordinary stock, all less income-tax, be declared for the half-year ended Dec. 31, 1933, payable on Feb. 27, 1934, and that the dividend warrants be sent to the proprietors by post."

Mr. William Alfred Surridge seconded the proposition, which was unanimously agreed to.

Re-Election of Director and Auditor.

The Chairman said he had very much pleasure in proposing the re-election of Mr. Arthur Edward Broadberry as a Director of the Company. He did not know how long he had been connected with the Company, but it was a very long time; and he had done a great deal of work for the Company on both works and district and was of the greatest advantage to his fellow Directors.

Mr. Edward Corbet Woodall seconded the resolution, which was carried unanimously.

Mr. Broadberry, in acknowledgment, thanked the Chairman for the kind terms in which he had proposed his re-election, Mr. Edward Woodall for seconding, and the proprietors generally for the unanimous way in which they had passed the resolution. As had been said, it was a great many years since he had first entered the services of the Company, and since then the Company's interests had always been his interests, and so long as he was connected with the Company they always would be.

On the proposition of Mr. F. Church, seconded by Mr. J. Taylor, the retiring Auditor, Mr. William Cash, Junr., was unanimously re-appointed, and Mr. Cash briefly acknowledged this renewal of their confidence.

Vote of Thanks.

Major E. T. Garland then proposed that the best thanks of the proprietors be given to the Chairman, Directors, and Auditors, and also to the Officers, staff, and workmen for their services to the Company during the past year. He paid tribute to the able services of the Directors and of the Secretary and Chief Engineer, and stressed the wonderful services given to the district by the diligence of the workmen. As one connected with property in the district he travelled about a great deal and had the opportunity of seeing the men at work, and he observed no playing with it; they were out to do their best for Directors and shareholders alike. He congratulated them on the way they carried out their work and the Directors on having such men to work for them. He referred also to the re-election of Mr. Broadberry as a Director, remarking that he had known him for many years. In 1914, when he (the speaker) said "good-bye" before leaving for France, Mr. Broadberry carried on for him while he was away, and he would never forget his kindness. He was delighted that he had been re-elected a Director.

Mr. J. T. Randall, in seconding the vote of thanks, said that the Chairman's address had been exceedingly interesting, and he was confident with him in not having any anxiety as to the future of the Industry. In regard to Mr. Broadberry, he was particularly pleased to hear of his re-election. Mr. Broadberry's modesty prevented him from saying when he was appointed to the Tottenham Company; but he could say that it was very nearly 50 years ago, because it was 48 years since he himself joined the Company, and it had been a pleasure all that time to serve with Mr. Broadberry.

The Chairman, in responding to the vote of thanks, said the Directors were very glad to know that the shareholders were pleased with what they had done, and equally glad to know they appreciated the services of the staff and workpeople. The tribute Major Garland had paid to the men was very high, for he had the opportunity of seeing them when no one was looking on. They were very proud to have such able and contented workpeople and glad to feel that the shareholders appreciated this.

Mr. H. C. Smith (Chief Engineer) also responded on behalf

of the engineering staff and workpeople, and said how glad he was to hear Major Garland say what he did in regard to the district men. Whatever the Company might institute or organize, they had to depend upon the men doing their jobs properly; for, so far as the consumers were concerned, the men were the Gas Company. He would see that the vote was conveyed to the proper quarter.

Mr. E. J. K. FUSSELL acknowledged the vote of thanks on behalf of the secretarial staff, who, he said, carried out their work very well indeed. They had recently added two more "children" to their family—namely, Hitchin and Stevenage—and he trusted that they would grow up healthy.

The meeting then terminated.

Gas Companies' Results in 1933

Aberystwyth.

The Directors of the Aberystwyth Gas Company submit a report for the year 1933 which shows that the balance of net revenue after taking into account the sum of £2,371 brought forward from 1932, and after payment of debenture interest and dividends to June 30, 1933, and after transferring £550 to the reserve fund account amounts to £3,122. The Directors recommend the payment of the usual dividends, less income-tax—viz., at the rate of 15% per annum on the original shares, 10½% on the new shares, 5% on the preference shares, and 4½% interest on the debenture bonds, less the interim dividends paid on Sept. 1 last.

Andover.

A very satisfactory increase of business is reported by the Andover Lighting and Power Company. The sale of gas is up by over 2,000,000 c.ft., and the number of consumers has been increased by 167. About 1½ miles of new mains have been laid during the year, and with the building developments now proceeding the demand for gas is still increasing. On the profit and loss account the balance carried forward was £3,019 against £3,158 in 1932. The difference was entirely due to larger figures payable on income-tax. The loan account was lower by £500, and the suspense account had been reduced by a few pounds short of £1,000, leaving the account to date at £5,631.

Bristol.

The number of consumers served by the Bristol Gas Company is 112,875—an increase of 3,430 by comparison with 1932, and the number of cookers supplied by the Company has increased to 101,019. There was a record demand for domestic and industrial gas appliances during the year. The Directors recommend that a dividend be declared for the half-year ended Dec. 31 last, at the rate of 5% per annum, less income-tax, on the nominal capital of the Company entitled to dividend.

Canterbury.

The sales of gas by the Canterbury Gas and Water Company during the year show a small decrease of 1·8%, as compared with the previous year. A new vertical steam boiler and condenser plant have been fixed in replacement of plant obsolete. After payment of interest on the loan capital, there is standing to the credit of the dividend account the sum of £7,268. An interim dividend of 4% having been paid in August last, the Directors now recommend a further dividend of 5%, less income-tax, making the uniform dividend on the total ordinary capital of 9% for the year.

Cheltenham.

The Directors of the Cheltenham and District Gas Company submit accounts for the year 1933, showing a profit of £27,393. The Directors propose to allocate a sum of £10,000 in reduction of the new area suspense account, and £2,000 to a special retort renewal fund, carrying forward in the profit and loss account the sum of £11,618 subject to the half-year's dividend to Dec. 31, 1933. The quantity of gas sold to consumers during the year was 619,911,600 c.ft., a slight decrease—viz., 0·43%—on the quantity sold during the preceding year, a decrease which would have been considerably more marked had it not been for the Company's recent extensions of the area of supply. The Company now commands a potential area of supply of over 300 square miles. A new gasholder of 100,000 c.ft. capacity has been erected at Broadway, and a similar holder is in course of erection at Pershore. The Directors recommend the payment of a dividend at the rate of 5% per annum on the paid-up consolidated ordinary stock of the Company for the year.

Chester.

The Directors of the Chester United Gas Company present a report for the year 1933, which states that the balance of net revenue account, after payment of interest and dividend on debenture and preference stocks and the interim dividend on ordinary stock, is £13,453, from which the Directors recommend the payment of a dividend on the ordinary stock of 3¾%, making 5¾% for the year. After appropriation of the amount required for this dividend (£5,412) the balance to carry forward will be £8,040. Under the provisions of a Board of Trade Order £41,890 4% redeemable debenture stock was created and issued to replace that amount of 5% debenture stock which had been redeemed on June 30 last.

Colchester.

The quantity of gas sold by the Colchester Gas Company shows an increase of 3% compared with the previous year. The numbers of gas appliances disposed of to consumers exceeded all previous records, and a large staff of gas fitters was kept fully occupied in this important side of the Company's business. To provide additional capital for the extension of the business a sale of shares took place locally in May last, and the prices realized were very satisfactory. The gross profit on the revenue account amounts to £16,053, compared with £13,434 in the previous year. Interim dividends were paid in September at the following rates: £5 15s.% on the "A" shares, £4 0s. 6d.% on the "B" shares, and £3% on the 6% preference stock, and the Directors recommend the payment of final dividends at the same rates, less income-tax. The full dividends for the year, therefore, will be £11 10s.% on the "A" shares, £8 1s.% on the "B" shares, and £6% on the 6% preference stock.

Derby.

The Directors of the Derby Gaslight and Coke Company present a report for the year ended Dec. 31, 1933, which states that an interim dividend of 3½% was paid on the ordinary stock for the June half-year, and the Directors now recommend a final dividend of 5%, making 8½% (less income-tax) for the year. The Company's business continues to expand, and consumers increased in number during the year by 1,491, bringing the total to 51,905. The output of gas shows an increase of over 50 million c.ft., or nearly 3% for the whole year. Although mild weather and trade depression were responsible for a decrease in the early months, the improved industrial conditions were reflected by an increase of about 13% during the latter part of the year. There has been an increase of 1,983 in the number of gas cooking stoves and fires sold or let out on hire, in addition to 4,178 other gas appliances for domestic and industrial purposes. A further sum of £20,000 has been transferred to the development fund account, which now stands at £80,000. The bulk supply of purified coke oven gas from Blackwell and Clay Cross coke ovens quite justifies anticipations. During the twelve months 54·67% of the gas supplied was obtained from these coke ovens. Cavendish Street Works, Derby, and the Belper Works remain shut down as regards gas production.

Dorchester.

The Directors of the Dorchester Gas and Coke Company present a report for the year ended Dec. 31, 1933, which states that the demand for gas has again been well maintained, the amount sold for the year being 392,335 therms, or 87,185,500 c.ft., which compared with the previous year shows an increase of 3,075,900 c.ft., or 3·65%. The Directors in their last report reminded the shareholders that the Company was entering upon the one hundredth year of its career; a short history of the Company's activities over this period has been compiled. The Directors recommend a final dividend of 6% on the preference capital, less income-tax, and 10% on the ordinary capital, free of income-tax.

East Surrey.

The business of the East Surrey Gas Company continues to expand satisfactorily. The number of consumers added during the year was 1,183. The Directors issued by tender, in August, £30,000 4½% redeemable preference stock, which was heavily over-subscribed and realized an average price of £110 9s. 2d.%. During the year advantage was taken of the provisions of the Gas Undertakings Act, 1932, to acquire a majority interest in the Horsham Gas Company, Ltd., and on Sept. 1 last the control of that Undertaking became effective. Dividends at the under-mentioned rates per annum respectively—6% on the cumulative preference stock, 5½% on the preference "A" stock, and 6% on the ordinary "B" stock, all less income-tax—were paid for the half-year to June 30. The Directors recommend that similar dividends be paid in respect of such capital, and at the rate of 4½% per annum on the redeemable preference stock, for the second half-year (less income-tax) payable on March 1 next, leaving a balance of £5,342 to be carried forward.

Hartlepool.

The profit of the Hartlepool Gas and Water Company for the year, after including Grants received from H.M. Treasury under Development (Loan Guarantees and Grants) Act, 1929, and paying interest on debentures, &c., is £27,780, which, together with the sum of £23,559 brought forward from last year, makes a total of £51,339. After paying an interim dividend of 2½% less income-tax, there remains an available balance of £37,614, out

of which the Directors now propose to declare a final dividend of 2½% less income-tax (making 5% for the year), absorbing £13,725, and leaving a balance of £23,889 to carry forward to the next account.

Lostwithiel.

A dividend of 7s. 6d. on the "A" shares and 1s. 6d. on the "B" and "C" shares was agreed on the recommendation of the Directors at the annual meeting of the Lostwithiel Gaslight and Coke Company, Ltd.

Leatherhead.

During the year the sale of gas by the Leatherhead Gas and Lighting Company increased by nearly 2¼%. In October last the Directors issued £5,000 of 4% debenture stock at 102%. The accounts show that, after deducting the dividends paid in September, and providing for all fixed charges and interest, there remains for division a balance of £5,591. The Directors recommend the payment of dividends for the second half-year as follows: On the preference stock 3%, making a total of 6% for the year; on the redeemable preference stock 3½%, making a total of 6½% for the year, and on the ordinary shares 4½%, making, with the interim dividend of 2½%, a total of 7% for the year. These dividends (less tax) will absorb £4,365, and leave £1,225 to be carried forward to the next account.

Oxford.

The Directors of the Oxford and District Gas Company recommend payment of dividends for the half-year ended Dec. 31, 1933, at the full nominal rates per annum on the 5% preference stock and 6% redeemable preference stock respectively, and also at the rate of 10% per annum on the consolidated ordinary stock, all less income-tax. These payments, with the interim dividends on the 5% preference stock, 6% redeemable preference stock, and consolidated ordinary stock paid for the half-year ended June 30, 1933, make 5%, 6%, and 10% respectively for the whole year. The Directors have again to report a considerable increase in the consumption of gas during the year, and that the demand for all types of gas appliances continues good. From the reading of meters at the March quarter, as an alternative to the flat rate charge for gas applicable to all consumers, they introduced a two-part tariff further to encourage the use of gas. The Directors report that the work of laying down the new mains in the extended area of gas supply, as authorized by the Oxford and District Gas Order of 1932, was completed by the month of April last year, and that there are already 900 houses obtaining a supply therefrom.

Stamford.

A profit on the year's working of £3,185 was reported at the annual meeting of the Stamford and St. Martin's Gas Light and Coke Company. After payment of the year's interest on mortgage, preference dividends, interim dividend on original stock, income-tax, &c., there was a balance of £5,148 available for disposal. Mains had been laid to the new housing estate, and in practically every house in the town gas was being installed for some service. A final dividend was agreed of 7% (making 13% for the year), leaving to be carried forward the sum of £4,321.

Winchester.

The Directors of the Winchester Water and Gas Company submit a report for the year ended Dec. 31, 1933, which shows that the balance of net revenue available for dividend is £13,194. Interim dividends of £2, £2 15s., and £2 10s.% on the preference stocks, and £2 10s.% on the consolidated ordinary stock, less income-tax, were paid in September last, and the Directors recommend the payment of final dividends of £2, £2 15s., and £2 10s.% on the preference stocks, and £3% on the consolidated ordinary stock, all less income-tax. The additional ½% on the consolidated ordinary stock represents the undivided portion of the authorized dividend for the half-year ended Dec. 31, 1906. The Directors report an increase in the sales of gas for the year of over 4 million c.ft., in spite of increased electrical competition and the milder weather during the spring and autumn. The gas mains have been extended.

York.

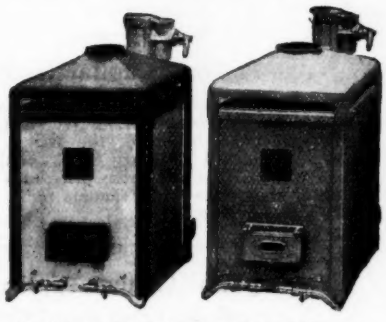
The profit of the York Gas Company for the year amounts to £16,892, to which is added the balance of net revenue brought forward from last year, £11,815, grants received from H.M. Treasury under Development (Loan Guarantees and Grants) Act, 1929, £143, and interest from reserve fund investments, £984, making a total to the credit of profit and loss (net revenue) account of £29,835. After deduction of interim dividends and debenture interest there remains a balance of £19,144, out of which the Directors recommend the payment of balance dividends as follows: On £50,000 "A" preference stock at £2% (making £4% for the year), less tax, and on £370,000 consolidated ordinary stock at £3% (making £5% for the year), less tax, leaving a balance of net revenue to be carried forward of £10,069. The quantity of gas accounted for during the year was 3,747,611 therms.

CENTRAL HEATING

B.I.F., White City

Potterton's Gas fired Boilers have been adopted for the fourth time at the Textile Section of the British Industries Fair, Shepherd's Bush, where they are installed for warming the overhead Galleries, upwards of half-a-mile in length, including the Fashion Theatre and Mannequin Parade.

Inspection of important installations can be arranged by appointment.



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GAS MARKETS & MANUFACTURES

Stock Market Report.

[For Stock and Share List, see later page.]

Gilt-edged securities continued the chief feature of Stock Exchange business last week and prices again advanced. There were several factors responsible for the return to activity in this section chief among which was the success of the Australian Conversion Loan and also the good revenue return, while reluctance to sell on the part of holders by reason of the difficulty in finding suitable alternatives has naturally affected values. In this connection it is interesting to note that the view is now being expressed that trade recovery will have little, if any, effect on the values of these securities and that an even lower yield than that at present obtainable on this class of investment is not unlikely. Leading industrials also continued to rise and several have now reached levels at which the return is less than that on British Government stocks.

Gas stocks and shares were well supported, though with the exception of the usual half-yearly *ex* div. reductions there were few price changes. The outstanding increase was a gain of 4½ points in Derby consolidated which reached 179½ on the Nottingham Exchange, and at this price, which at the time of writing includes the full final dividend of 5%, the yield on an 8½% dividend basis works out at £4 14s. 8d.%. British 7% preference and Cambridge 5% debenture both rose 2 to 155½ and 117½ respectively, and the Commercial and South Metropolitan 3% debentures each gained 1. The only drop occurred in Imperial Continental which declined 3 points to 207.

No well-spread list of investments is complete without a holding of Gas Light £1 units, and the present time presents a favourable opportunity for purchasing. They are usually readily obtainable, and at the time of writing 25,000 are on offer at 26s., yielding £4 6s. 2d.% on a dividend of £5 12s.%. A similar amount of South Metropolitan ordinary stock is also on offer at 133½, the yield in this case being £4 9s. 10d.% on a 6% basis, while £5,000 Commercial ordinary at 126 yields £4 11s. 3d.%, the dividend in this case being 5¾%, the rate paid for the past two years.

Current Sales of Gas Products.

The London Market for Tar Products.

LONDON, *Feb.* 26.

There is little change to report in the tar products market, with prices at about the following levels:

Pitch, 57s. 6d. per ton f.o.b.

Creosote, 3d. to 3¼d. per gallon.

Refined tar, 4d. to 4¼d. per gallon in bulk at makers' works.

Pure toluole, about 3s.; pure benzole, 1s. 10d. to 1s. 11d.; 95/160 solvent naphtha, about 1s. 9d.; and 90/140 pyridine bases, about 6s.—all per gallon naked at makers' works.

Tar Products in the Provinces.

Feb. 26.

The average prices of gas-works products during the week were: Gas-works tar, 23s. to 28s. Pitch—East Coast, 57s. 6d. to 60s. f.o.b. West Coast—Manchester, Liverpool, Clyde, 57s. 6d. to 60s.* Toluole, naked, North, 2s. 2d. to 2s. 4d. Coal-tar crude naphtha, in bulk, North, 6½d. to 6¾d. Solvent naphtha, naked, North, 1s. 6d. to 1s. 7d. Heavy naphtha, North, 10½d. to 11d. Creosote, *ex* works, in bulk, North, liquid and salty, 2½d. to 2¾d.; low gravity, 2d. to 2½d.; Scotland, 2½d. to 2¾d. Heavy oils, in bulk, North, 3¾d. to 4¼d. Carbolic acid, 60's, 2s. 1½d. to 2s. 2½d. Naphthalene, £10 to £11. Salts, 55s. to 75s., bags included. Anthracene, "A" quality, 2½d. to 3d. per minimum 40%, purely nominal; "B" quality, unsalable.

* All prices for pitch are now quoted on the basis of f.o.b. In order to arrive at the f.a.s. value at any port it will be necessary to deduct the loading costs and the tolls whatever they may be.

Tar Products in Scotland.

GLASGOW, *Feb.* 24.

Inquiries are quite plentiful, but actual business is somewhat slow. Prices, however, remain fairly steady in all departments.

Crude Gas-Works Tar.—The actual value is 35s. to 37s. per ton *ex* works.

Pitch.—Export value remains at round 50s. per ton f.o.b. Glasgow, while, in the home market, 50s. per ton *ex* works in bulk is obtainable for full wagon loads.

Refined tar is now being offered quite freely at 3¼d. per gallon *ex* works in bulk.

Creosote oil.—Owing to shortage of supplies in this district prices continue steady. B.E.S.A. Specification is 4d. to 4¼d. per gallon; low gravity, 4d. to 4¼d. per gallon; and neutral oil, 4d. to 4¼d. per gallon—all in bulk *ex* works.

Cresylic acid.—New business is not plentiful, but production is well looked after. Pale, 97/99%, is 1s. 1d. to 1s. 2d. per gallon; dark, 97/99%, 11d. to 1s. per gallon; and pale, 99/100%, 1s. 4d. to 1s. 5d. per gallon—all f.o.r. in buyers' packages.

Crude naphtha is valued at 4¾d. to 5¼d. per gallon, according to quality and quantity.

Solvent naphtha.—90/160 grade is 1s. 5d. to 1s. 6d. per gallon, and 90/190 grade is 10d. to 11d. per gallon.

Motor benzole commands 1s. 7d. per gallon *ex* works for available supplies.

Pyridines.—90/160 grade is higher at 4s. 6d. to 4s. 9d. per gallon, and 90/140 at 5s. to 5s. 3d. per gallon.

Benzole Prices.

These are considered to be the market prices for benzole at the present time:

	s. d.		s. d.	
Crude benzole . . .	0 10	to	0 10½	per gallon at works
Motor ,, . . .	1 5	,,	1 5½	,, ,, ,,
90% ,, . . .	1 5½	,,	1 6	,, ,, ,,
Pure ,, . . .	1 8½	,,	1 9	,, ,, ,,

Contracts Advertised To-Day.

Coal.

Milford Haven Urban District Council. [p. 572.]

Pipes and Specials.

Clacton Urban District Council. [p. 572.]

Trade Notes.

Change of Address.

Messrs. Mangin, Davson, & Partners, Ltd., inform us that they have moved to more commodious offices at 54, Victoria Street, S.W. 1. Their telephone number (Victoria 1752/4) remains unchanged.

Patents and Trade Marks.

From King's Patent Agency, Ltd., of 146A, Queen Victoria Street, E.C. 4, we have received a leaflet introducing the 19th Edition of "Patents and Trade Marks," by Benj. T. King, C.I.M.E. The firm offer their services in connection with the protection of patents and trade marks, and their experience is based on 48 years' active practice.

New Capital Issues.

Peterborough Gas Company.—As will be seen from our advertisement columns, Messrs. A. & W. Richards are offering for sale by tender on behalf of the Directors of this Company £15,000 consolidated ordinary stock ranking for a standard dividend of 7%. The minimum price of issue is £150 per £100, yielding at that price 5%. Tenders must be received not later than 11 a.m. on March 13.

Special Order Applications.

Bingley Urban District Council.

Application is being made by the Council for a Special Order to provide for the acquisition by them of so much of the undertaking of the Bradford Corporation as is situated in or relates to the Urban District of Bingley, and to authorize the utilization of scheduled lands for gas purposes, &c.

Plant, &c., for Sale.

It will be recalled that, in connection with the Friern Barnet Urban District Council's announcement on p. 508 of last week's "JOURNAL," the last date for receipt of quotations was given as Feb. 9. This date has been altered to March 5.

STOCK AND SHARE LIST.

Official Quotations on the London and Provincial Stock Exchanges.

Issue. £	Share.	When ex-Dividend.	Dividends. Prev. Hf. Yr. % p.a.	Dividends. Last Hf. Yr. % p.a.	NAME.	Quotations. Feb. 24. (Provincial Exchanges Feb. 23.)	Rise or Fall on Week.	Transactions. Lowest and Highest Prices During the Week.
1,551,868	Stk.	Oct. 9	7	7	Alliance & Dublin Ord. ...	129—134	+1	133½
374,000	"	Jan. 8	4	4	Do. 4 p.c. Deb. ...	90—100	...	...
557,655	"	Aug. 28	7	7	Barnet Ord. 7 p.c.	167—172	...	...
300,000	1	Oct. 23	1/9⅔	1/4⅔	Bombay, Ltd.	26/6—28/6	...	...
178,480	Stk.	Feb. 19	9½	9½	Bournemouth sliding scale	196—205*	...	...
550,050	"	"	7	7	Do. 7 p.c. max. ...	161—166*	−2	165
489,160	"	"	6	6	Do. 6 p.c. Pref. ...	135—140*	−3	...
50,000	"	Dec. 18	3	3	Do. 3 p.c. Deb. ...	75—80	...	...
262,025	"	"	4	4	Do. 4 p.c. Deb. ...	100—105	...	102½—103
335,000	"	"	5	5	Do. 5 p.c. Deb. ...	120—125	...	...
357,900	"	Aug. 28	7½	7½	Brighton, &c., 6 p.c. Con. ...	164—169	...	167—168
540,000	"	"	6⅔	6⅔	Do. 5 p.c. Con. ...	151—156	...	155—155⅔
196,500	"	"	6	6	Do. 6 p.c. B. Pref.	136—141	...	139½
1,487,500	"	July 24	5	5	Bristol 5 p.c. max.	117—118a	...	...
120,420	"	Dec. 18	4	4	Do. 1st 4 p.c. Deb. ...	100—102a	...	...
217,870	"	"	4	4	Do. 2nd 4 p.c. Deb. ...	100—102a	...	...
338,790	"	"	5	5	Do. 5 p.c. Deb.	120—123a	...	...
885,000	"	Sept. 25	8	7	British Ord.	155—160	...	157—158½
100,000	"	Dec. 18	7	7	Do. 7 p.c. Pref.	153—158	+2	155½
350,000	"	"	5½	5½	Do. 5½ p.c. Pref.	106—111	...	...
120,000	"	"	4	4	Do. 4 p.c. Red. Deb. ...	95—100	...	99
450,000	"	"	5	5	Do. 5 p.c. Red. Deb. ...	107—112	...	...
160,000	"	Jan. 8	5	5	Cambridge 5 p.c. Deb. ...	115—120	+2	...
100,000	10	May 22	6	4	Cape Town, Ltd.	5⅛—6⅛	...	5⅛
100,000	10	Nov. 6	4½	4½	Do. 4½ p.c. Pref. ...	6⅝—7⅝	...	...
150,000	Stk.	Dec. 18	4½	4½	Do. 4½ p.c. Deb. ...	95—100	...	98—98½
626,860	"	Feb. 19	6	6	Cardiff Con. Ord.	121—126*	−2	...
237,860	"	Jan. 8	5	5	Do. 5 p.c. Red. Deb.	103—108	...	...
157,150	"	Aug. 14	6½	5	Chester 5 p.c. Ord.	115—125b	...	...
98,936	1	Oct. 9	2/-	2/-	Colombo, Ltd. Ord.	1⅞—1⅞	...	...
24,500	1	"	1/4½	1/4½	Do. 7 p.c. Pref. ...	19/- 21/-	...	...
609,204	1	Oct. 9	/11'48	/11'48	Colonial Gas Assn. Ltd. Ord.	1⅝—1⅞	...	20/4½—20/6
296,058	1	"	1/8'30	1/8'30	Do. 8 p.c. Pref.	23/- 25/-	...	24/7½—24/9
1,775,005	Stk.	Feb. 19	5	6⅔	Commercial Ord.	120—125*	−2	120—122½
478,000	"	Dec. 18	3	3	Do. 3 p.c. Deb. ...	76—81	+2	78
286,344	"	"	—	5	Do. 5 p.c. Deb. ...	121—126	...	122½
807,560	"	Feb. 19	7	7	Croydon sliding scale ...	151—156*	−2	151—156
569,590	"	"	5	5	Do. max. div.	103—108*	−2	108⅔—109
620,385	"	Jan. 8	5	5	Do. 5 p.c. Deb. ...	120—125	...	121⅔
543,270	"	Aug. 14	10	7	Derby Con.	177—182c	+4½	...
56,000	"	Jan. 8	4	4	Do. 4 p.c. Deb. ...	98—100c	...	...
209,000	"	Feb. 19	6	6	East Hull Ord. 5 p.c. ...	106—111*	−2	106—107
179,500	"	Aug. 28	6	6	East Surrey Ord. 5 p.c. ...	128—133	...	...
155,019	"	Dec. 18	5	5	Do. 5 p.c. Deb. ...	115—120	...	...
1,002,180	"	Sept. 25	†7	†5	European, Ltd.	125—135	...	126—128
19,342,763	"	Feb. 19	5⅔	5⅔	Gas Light & Coke 4 p.c. Ord.	25/—26/-f*	−1/6	25/0⅔—26/9
2,600,000	"	"	3⅔	3⅔	Do. 3⅔ p.c. max. ...	86—89*	−1	87½—88
4,477,106	"	"	4	4	Do. 4 p.c. Con. Pref. ...	103—105*	−1	103—103⅔
5,103,497	"	Dec. 18	3	3	Do. 3 p.c. Con. Deb. ...	82—85	...	83¼—84⅔
3,642,770	"	"	5	5	Do. 5 p.c. Red. Deb. ...	114—117	...	115⅔—116⅔
3,500,000	"	"	4½	4½	Do. 4½ p.c. Red. Deb. ...	113—116	...	114—114⅔
270,466	"	Aug. 28	6	6	Harrogate New Cons. ...	120—125	...	...
82,500	"	Aug. 28	7	7	Hastings & St. L. 5 p.c. Conv.	149—154	...	...
258,740	"	"	5½	5½	Do. 3½ p.c. Conv	117—122	...	...
140,000	1	Oct. 9	†10	1/7½	Hongkong & China, Ltd. ...	29/— 32/-	...	29/-
213,200	Stk.	Aug. 14	6	6	Hornsey Con. 3½ p.c. ...	130—135	...	...
5,600,000	"	Nov. 6	14	10	Imperial Continental Cap.	202—212	−3	204½—209½
223,130	"	Feb. 5	3½	3½	Do. 2½ p.c. Red. Deb.	89—94	...	92—92½
235,242	"	Aug. 14	8½	8½	Lea Bridge 5 p.c. Ord. ...	172—177	...	...
2,145,907	"	Aug. 14	6	6	Liverpool 5 p.c. Ord ...	132—134b	...	...
345,500	"	Dec. 18	5	5	Do 5 p.c. Red. Pref. ...	101—111b	...	...
306,083	"	July 17	4	4	Do. 4 p.c. Deb. ...	100½—102½b	...	...
165,736	"	Feb. 19	8	10	Maidstone 5 p.c. Cap. ...	180 190*	...	...
56,176	"	Jan. 8	3	3	Do. 3 p.c. Deb. ...	72—77	...	...
75,000	5	Dec. 4	†10	†10	Malta & Mediterranean ...	9—11	...	...
392,000	—	Oct. 2	5½	5½	Metropolitan (of Melbourne) 5½ p.c. Red. Deb.	98—108	...	...
231,978	Stk	Feb. 19	5	5	M. S. Utility "C." Cons. ...	109—114*	−2	...
818,657	"	"	4	4	Do. 4 p.c Cons. Pref.	93 98*	−2	...
360,075	"	Jan. 8	4	4	Do. 4 p.c. Deb. ...	100—105	...	...
148,955	"	"	5	5	Do. 5 p.c. Deb. ...	117—122	...	...
675,000	"	31 May '33	†6	6	Montevideo, Ltd.	60—70	...	68½
2,061,315	"	Aug. 14	5⅔	5	Newcastle & Gateshead Con.	26/—26/d	...	...
682,856	"	"	4	4	Do. 4 p.c Pref. ...	101—102d	...	...
776,706	"	Jan. 8	3½	3½	Do. 3½ p.c. Deb. ...	90½—91½d	...	...
277,285	"	Nov 6	5	5	Do. 5 p.c. Deb. '43 ...	105—107d	...	...
274,000	"	Feb. 19	5	5	Newport (Mon.) 5 p.c. max.	101—108a*	−2	...
204,940	"	Aug. 28	7½	7½	North Middlesex 6 p.c. Con.	157—162	...	...
396,160	"	Feb. 5	5	5	Northampton 5 p.c. max. ..	99—104	...	...
300,000	"	Dec. 4	7	†9	Oriental, Ltd.	147—152	...	150—150½
316,617	"	Dec. 18	8	8	Plym'th & Stonehouse 5 p.c.	165—170	...	...
504,416	"	Feb 19	8	8	Portsm'th Con Stk. 4 p.c. Std	167—172*	−2	169
241,446	"	"	5	5	Do. 5 p.c. max. ..	100—10?*	−2	...
114,000	"	Feb. 19	5	5	Preston 5 p.c. Pref.	103—105*	−2	...
686,312	"	Jan. 22	4	4	Primitiva 4 p.c. Rd. Db. 1911	87—92	...	89½—90½
389,813	"	Dec. 18	4	4	Do. 4 p.c. Cons. Deb.	88—93	...	91—91½
150,000	10	Sept. 25	6	6	San Paulo 6 p.c. Pref. ..	6½—7½	...	...
1,736,968	Stk.	Sept. 11	6	6	Sheffield Cons.	135—137e	...	...
95,000	"	Jan. 8	4	4	Do. 4 p.c. Deb.	90—94e	...	...
133,201	"	Feb. 19	8½	5	Shrewsbury 5 p.c. Ord. ...	135—140*	−2	...
90,000	10	June 12	15	14	South African	8—5	...	...
6,709,895	Stk.	Feb. 19	5	7	South Met. Ord.	130—135*	−4	130½—134
1,135,812	"	"	6	6	Do. 6 p.c. Irred. Pf.	136 141*	−2	137½
850,000	"	"	20/-g	4	Do. 4 p.c. Irred. Pf.	100—104*	−2	102—102½
1,895,445	"	Jan. 8	3	3	Do. 3 p.c. Deb ...	81—84	+1	82½—84
1 000,000	"	Jan. 22	5	5	Do. 5 p.c. Red. Deb.	111—115	...	...
209,820	"	Feb 19	8½	8½	South Shields Con.	169—170d*	−1	...
1,548,795	"	Feb. 19	6	6	South Suburban Ord. 5 p.c	130—135*	−2	132—133½
512,825	"	"	5	5	Do. 5 p.c. Pref.	112—117*	−2	...
300,000	"	"	—	4	Do. 4 p.c. Pref.	99—102*	−1	...
868,837	"	Dec. 18	5	5	Do. 5 p.c Deb.	120—125	...	122½
100,000	"	"	4	4	Do. 4 p.c. Deb.	100—103	...	...
647,740	"	Aug. 28	5	5	Southampt'n Ord. 5 p.c. max.	111—116	...	...
121,275	"	Dec. 18	4	4	Do. 4 p.c. Deb.	97—102	...	...
350,000	"	Aug. 28	5½	5½	Swansea 5½ p.c. Red. Pref.	108—113	...	...
200,000	"	Dec. 18	6½	6½	Do. 6½ p.c. Red. Deb.	103—108	...	...
1,076,490	"	Aug. 14	6⅔	6⅔	Tottenham and District Ord.	150—155	...	152—152½
300,000	"	"	5½	5½	Do. 5½ p.c. Pref. ..	125—130	...	126—127
62,235	"	"	5	5	Do. 5 p.c. Pref. ...	112—117	...	...
199,005	"	Dec. 18	4	4	Do. 4 p.c. Deb. ...	97—102	...	100½
85,701	"	Oct. 9	6	6	Tuscan, Ltd. 6 p.c. Red. Db.	90—100	...	...
349,110	"	Aug. 28	7	7	Uxbridge, &c., 5 p.c. ...	149—154	...	...
88,330	"	"	5	5	Do. 5 p.c. Pref. ...	112—117	...	...
1,322,220	"	July 10	7	7	Wandsworth Consolidated	155—160	...	155½—158
1,096,373	"	"	5	5	Do. 5 p.c. Pref.	119—124	...	124
1,317,964	"	Dec. 18	5	5	Do. 5 p.c. Deb.	120—125	...	124½
158,400	"	Aug. 28	6A	5	Winchester W.& G. 5 p.c. Con.	115—120	...	...

Quotations at:—*a.*—Bristol. *b.*—Liverpool. *c.*—Nottingham. *d.*—Newcastle. *e.*—Sheffield. *f.*—The quotation is per £1 of stock *g.*—For quarter. *h.*—Paid £3, including 10s. on account of back dividends. *i.*—The interest due 1/9/33 was paid on that date * Ex. div. † Paid free of income-tax. ‡ For year. Hongkong & China, Ltd.—paid on £10 shares.

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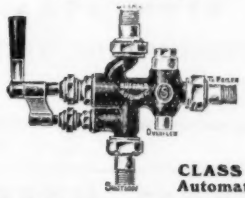

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See issue of December 6th, for full particulars of **the new E.B. Patch** for use with this Gun.

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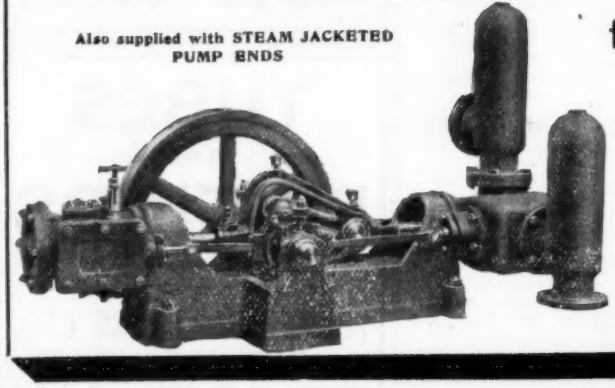

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